

Aviation Week & Space Technology

75 Cents

A McGraw-Hill Publication

December 10, 1962

**727 Aimed At
All-Weather
Capability**

Boeing 727 Rollout



SPECIAL REPORT:

Army Program Tests Bell UH-1B at High Speeds

60 CPS REF. EVENT

Honeywell test instrumentation records structural soundness of missiles

System records 112 test parameters simultaneously

Wyle Laboratory, at its Menlo Park, California, facility, tests the structural soundness of Minuteman, Polaris, and Skybolt missile stages under transportation conditions with a battery of four multiplexed Model 1012 Viscometer oscillographs. The tests, Wyle-Honeywell systems at the Wyle test area includes eight 1012 Viscometers, 24 Acordata III amplifiers, and a 14 channel VMA tape recorder.

The Wyle test area uses Wyle hydroshaker systems of about 100,000 force pounds, mounted on million pound concrete reaction blocks. . . the only installation of its magnitude in the country. The hydroshaker systems introduce vibration into the missiles comparable to those encountered during transportation prior to launching.

The system record shows data recorded from accelerometers on the third stage of a missile at the locations marked on the record.

The clarity, contrast, and easy readability of all Honeywell Viscometer records is vividly shown in this record. Where traces are numerous and of the complexity or greater, the time-identifier interruptions, occurring at regular intervals along the time base of the record, make it easy to identify the individual traces.

For details about Honeywell Signal Conditioning equipment, the Model 1012, and other Viscometer oscillographs, and the LAR 7400 FM Tape Sub-system, write: Honeywell-Honeywell, Inc., 1000 Main Street, 4600 E. Dry Creek Road, P.O. Box 6776, Denver, CO. Telephone DDD Area Code 303-796-0111.



The Honeywell LAR 7400 FM tape system stores 14 channels of data.

A battery of multiplexed Model 1012 Viscometers directly records 112 parameters of information.

Honeywell

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The lifting wing is one design approach to VTOL (vertical take-off and landing) capability. There are others, but one factor they all have in common is heavy reliance on hydraulic power for the transition from vertical to horizontal flight and back again.

Taking engines, ducted fans, free fans, overwing flaps, thrust deflectors, separate lift engines, or various combinations of these elements all involves unprecedented extensions of the hydraulic system. Because they are so extensive, the systems often must operate close to "wet spots."



Given these operating conditions, the specification almost writes itself: Fire-resistant Skydrol for the hydraulic systems of VIRTOL aircraft.

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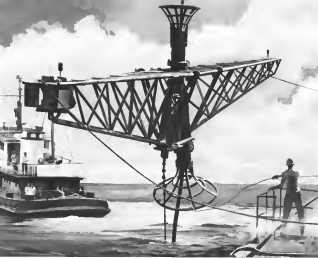
■ LITTON INDUSTRIES
ELECTRON TUBE DIVISION



Arrange an interview at our Data Systems Division by directing

ANSWER TO LAST WEEK'S PROBLEM 5:708 $1122 = N_1 + C$, $2310 = N_2 + C$ so that C divides 1122 and 1188, and hence C divides the greatest common divisor of these numbers. The \gcd is 17, a prime, so that $C = 17$ with $N_1 = 66$, $N_2 = 130$.

ANIMATION WEEK and SPACE TECHNOLOGY, December 30, 1992



Putting ears in the ocean

Unique underwater sound laboratory built by Lockheed helps U.S. Navy measure submarine noise.

The sea is saturated with sounds—the motion of the waves, the hum of ships and the hum of marine life. Lifting out single sounds—such as the noise of a distant submarine—may be as difficult as hearing a pebble tossed into a puddle above a thunderstorm.

The U.S. Navy has embarked upon a high-priority underwater test facility known as the Atlantic Underwater Test and Evaluation Center (AUTEC). This undertaking may well achieve importance tantamount to the nation's achievements in space.

Lockheed Electronics Company was chosen by the Navy as team manager to direct the design and installation of the first operational range of this vast program.

Innovative Designers of Lockheed engineered and developed a bottom-mounted acoustic array, rendering a sensitive hydrophone system for the surveillance, detection and measurement of underwater sounds.

Practical Packages of Lockheed housed the system to operate efficiently under the enormous pressure and other adverse conditions encountered underwater.

Engineering Follow-through teams

of Lockheed directed the installation of the hydrophone array in deep water—and completed test and checkout of the system to assure optimum operation in that environment.

Lockheed offers these innovative designers, practical packages and engineering follow-through capabilities to the defense and civilian electronic industries alike. LEC is the electronics gateway to several thousand scientists, engineers and technologists who work for Lockheed.

Engineers and Scientists: For career advancement opportunities with this talented team, please contact our Professional Placement Office, Fairfield, N.J. An equal opportunity employer.

LOCKHEED ELECTRONICS COMPANY
PLAINTIFF, NEW JERSEY
A Division of Lockheed Aircraft Corporation

AEROSPACE CALENDAR

(Continued from page 7)

- Apr. 20-21-40th Symposium on Tapering Aspects of Magnetically Induced Motion, University of California, Berkeley
- Apr. 19-21-Hypersonic Research Conference, American Rocket Society and American Society of Mechanical Engineers, Naval Ordnance Laboratory, White Oak, Md.
- Apr. 21-29-International Nuclear Magnetic Conference, Rochester Hotel, Washington, D.C.; Japanese Association Institute of Electrical Engineers, IRE
- Apr. 21-18-Industrial Conference and Electronic Show, Forterra at Radio Engineers, Dallas Memorial Auditorium, Dallas, Tex.
- Apr. 21-26-Technical Meeting, Nuclear Materials for Space Applications, American Nuclear Society, Sheraton Hilton Hotel, Cincinnati, Ohio
- Apr. 21-23-Annual Meeting, National Association of Service Arms, Washington, D.C.
- Apr. 21-24-Second Manned Space Flight Symposium, Institute of the Aerospace Sciences in conjunction with NASA and AFSC, Dallas, Tex.
- Apr. 22-24-Third Annual San Diego Symposium for Research in Engineering, Ed Webb's Groundwork, San Diego, Calif.
- Apr. 24-25-Seventh Region Technical Conference, Institute of Radio Engineers, San Diego, Calif.
- Apr. 29-May 9-Annual Conference, Society of Photographic Scientists and Engineers, Ambassador Hotel, New York City, N.Y.; Co-sponsors: Army Research Office
- May 1-3-7th Annual National Forum, American Helicopter Society, Sheraton Hotel, Washington, D.C.
- May 1-3-Research Conference, Annual on Rocket Society and Aerospace Media Assn., Los Angeles, Calif.
- May 21-24-Fourth National Symposium on Plasma Physics, Brookhaven Institute of Radio Engineers, Mather, Twin Bridges Hotel, Washington, D.C.
- May 14-15-Symposium on Reliability and Maintainability Meeting, Institute of the Aerospace Sciences, Washington, D.C.
- May 17-18-Electronic Components Conference, Institute of Radio Engineers, Sheraton Twin Bridges Hotel, Washington
- May 19-21-National Aerospace Electronics Conference, Institute of Radio Engineers, Dayton, Ohio
- May 19-21-Cosponsored General Flight Physics Second National Symposium on Aerodynamics, Hartford, Conn.
- May 20-21-National Symposium on Microwave Theory and Technology, Institute of Radio Engineers, Mather Hotel, Santa Monica, Calif.
- May 20-22-National Telecommunications Conference, Hilton Hotel, Albuquerque, N.M.
- May 21-23-Symposium on Computer Control, American Federation of Industrial Management, Sheraton, Costa Hotel, Detroit, Mich.
- May 22-24-Seventh National Conference on Product Engineering, Engineers, Institute of Radio Engineers, Continental Hotel, Cambridge, Mass.
- June 7-16-15th French International Air Show, Le Bourget, Paris, France

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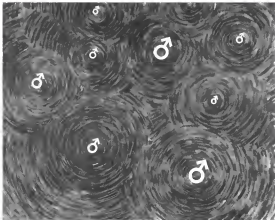
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Exploration of the universe by spacecraft capable of safely transporting men takes vast down-to-earth preparations. That's why Douglas is now building the nation's most modern research and development facility as a 245 acre site in Huntington Beach, California. The Douglas Space Systems Center will include a space simulation chamber 20 km in diameter, capable of housing a complete manned spacecraft. Supplementing this will be a complex of specialized research laboratories.

MAN-RATED SPACECRAFT

...AND WHAT DOUGLAS IS DOING ABOUT THEM

Here, manned space systems will be proved in environments similar to those which will exist on orbital, lunar and interplanetary missions. If Douglas' understanding of space problems is a direct result of booster experience and manned vehicle experience with high performance military aircraft.



The new Douglas Space Center will further many of the more than 500 research programs now under way in company laboratories. And it will incorporate the sophisticated technological equipment required to solve the new problems man will meet as he begins to explore outer space.

DOUGLAS



HOW TO TALK LONG DISTANCE WITH A "FLYING ANTENNA"

For special-purpose, long-range communications, Fairchild Stratos-450 has created and developed Helvetor. An electric-powered rotary wing tethered cross, it can hover as high as 20,000 feet, stay aloft 1,000 hours without maintenance. The tether itself serves as the antenna for VLF and LF transmissions. Helvetor® can act as a sensor platform for official

short-range surveillance and a relay for UHF/VHF communications. The "Flying Antenna" is a complete, mobile, economical system, ready for immediate deployment and equally fast disengagement. Operating from land or sea, it can withstand the harshest weather. Interested? Let our Helvetor brochure tell you more. Contact our Director of Customer Relations.

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When there's a need to know, Fairchild Stratos-Electronic Systems Division capabilities are best reflected in an latest grant approach to data requirements. Extensive experience in acquisition, processing, transmission and display has given FS-ESD engineers a particularly sensitive awareness of both data information needs and the many refinements required to answer them. For knowledgeable engineers interested in career opportunities in advanced data techniques, any one

suggests a visit to our Director of Industrial Relations for the Division. "Give Your Own Future" FS-ESD, an equal opportunity employer.

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Precision line laying and tracking need precision instrumentation. Sperry has the capability and experience in instrumentation to meet the need.

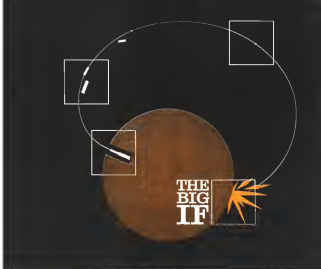
Sperry has system responsibility for the ARIS (Advanced Range Instrumentation Ship) program — tracking, tracking stations to collect accurate terminal trajectory and velocity data — a project incorporating every advanced technique in data handling, radar, data rates, navigation and associated technologies. In space vehicle tracking, Sperry has the best background going — with radar and associated interface experience from the minuscule (PPS-4) to the mighty (PPS-35) — plus creative capability in data control, both analog and digital, weapon direction equipment (Talos WDE) and other areas.

Most important, Sperry offers the ability successfully to tie together many diverse technological efforts into a reliable system — one that does the job consistently and does it well.



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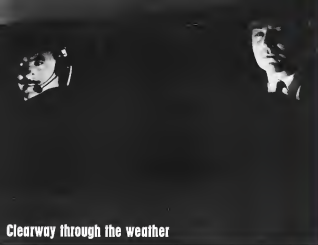
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CONTROLS IN THE MORNING - POSITION IN THE AFTERNOON

New CINCINNATI AUTOMATIC THOUSAND combines contouring and positioning in a single package. Modular, solid state, absolute movement, easier to program and operate—a practical read's control. Write for Bulletin M-2395 Control Division, The Cincinnati Milling Machine Company, Cincinnati 3, Ohio

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Clearway through the weather

all-weather operation and automatic landing is a crucial sector of aeronautical development, in which SMITHS can claim an unequalled record of pioneer work and practical progress. Already more than 8,000 fully automatic blind landings have been accomplished, without incident, by aircraft using the Autoland system evolved on the basis of the SMITHS Autopilot. The latest outcome of SMITHS initiative in fundamental research is the Para-Visual Director. This is an entirely new concept in flight director display, which can be applied to existing instrument systems. By presenting essential information to the pilot, even as he concentrates on the runway ahead, it effectively eases his task—especially in high-speed, low-visibility landings by modern jet aircraft.



The new Para-Visual Director (P.V.D.) combines and presents to the pilot, in an entirely new way, information previously available only to his instrument panel. It consists of small 'becker's pins' which indicate when the runway begins, ends or joins. These are readily visible even out of the corner of the eye. The pilot also receives constant information which enables him to maintain continuous awareness of the aircraft's attitude without affecting his vision from the runway. The P.V.D. is currently being evaluated by A.E.M. and other airlines and, currently, forms part of the complete runway flight control system installed on the B.P.A. de Havilland Trident—the first commercial aircraft to be specifically designed for all-weather flying.

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J-M Microbestos and J-M Micro-Quartz Fiber used to reinforce high-temperature plastics

From Johns-Manville, manufacturer of Min-K and Thermax (the only thermal insulations used aboard the Mercury Spacecraft), come two equally important products: J-M Microbestos Paper and J-M Micro-Quartz Fiber. They are designed to provide reinforcement for high-temperature plastics such as exhaust nozzles, nose cones and aero-dynamically heated surfaces. Microbestos Paper is a high-purity, high-bulk, uniform paper made of asbestos or asbestos in combination with other organic and inorganic fibers and fillers. It is capable of absorbing up to 80% room-temperature, moisture-containing products saturated with various resin systems are available from leading manufacturers of laminating sheets, tapes, and molding compounds.

Micro-Quartz is made of the highest purity silica fiber with thermo-physical properties similar to those of pure silica. It is available in bulk form in various fiber diameters for use as a reinforcement for high-temperature and ablative plastics.

For full details on these and other J-M aerospace insulations, write to J. R. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario, Cable: Johnsonville.

JOHNS-MANVILLE



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Ford Instrument Does It With Digits:

Synthesized above is Ford Instrument's proven configuration of the "strap-down" inertial guidance or navigation system. The "strap-down" concept replaces the stable platform . . . gynes are mounted directly to the vehicle frame and the platform functions are performed by a digital computer.

Developed by Ford Instrument, this system offers unprecedented space and weight savings together with flexibility as to placement of components and adaptability to sensor design changes.

The "strap-down" program was initiated as an ASO study at Wright-Patterson Air Force Base. The concept has been proven sound through an extensive flight test program.

Innovations such as this are evidence of Ford Instrument's well-balanced capability for rapid and successful accomplishment of research and development engagements, growing rapidly tempered by practical experience, technological solutions effectively directed by a dynamic management team.

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EDITORIAL

Supermarine Transport Shakes 21

COVER: First Boeing 737 transport rolls out at company's Renton, Wash. facility. Aircraft is powered by Pratt & Whitney JT8D-1 engines producing 34,500 lb. thrust each (AWC file). In air, aircraft will carry 150-174 passengers depending on interior configuration. For other details on the 737 transport see p. 40.

PICTURE CREDITS

Cover: Ron White, Boeing Aircraft Co.; 37, 73-NASA; 39-Ron White, Boeing Aircraft Co.; 43-Boeing; 45-Boeing; 47-Boeing; 52-Boeing; 59-Boeing; 95-Boeing; 104-Boeing; 112-Boeing; 134-Boeing; 135-Boeing; 136-Boeing; 137-Boeing; 138-Boeing; 139-Boeing; 140-Boeing; 141-Boeing; 142-Boeing; 143-Boeing; 144-Boeing; 145-Boeing; 146-Boeing; 147-Boeing; 148-Boeing; 149-Boeing; 150-Boeing; 151-Boeing; 152-Boeing; 153-Boeing; 154-Boeing; 155-Boeing; 156-Boeing; 157-Boeing; 158-Boeing; 159-Boeing; 160-Boeing; 161-Boeing; 162-Boeing; 163-Boeing; 164-Boeing; 165-Boeing; 166-Boeing; 167-Boeing; 168-Boeing; 169-Boeing; 170-Boeing; 171-Boeing; 172-Boeing; 173-Boeing; 174-Boeing; 175-Boeing; 176-Boeing; 177-Boeing; 178-Boeing; 179-Boeing; 180-Boeing; 181-Boeing; 182-Boeing; 183-Boeing; 184-Boeing; 185-Boeing; 186-Boeing; 187-Boeing; 188-Boeing; 189-Boeing; 190-Boeing; 191-Boeing; 192-Boeing; 193-Boeing; 194-Boeing; 195-Boeing; 196-Boeing; 197-Boeing; 198-Boeing; 199-Boeing; 200-Boeing.

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BFG tire laboratory roars down the runway

At a deserted airport in Florida, this odd looking vehicle helps B.F. Goodrich engineers design better tires for jet service.

The single tire at the rear of the vehicle carries a load of 38,500 pounds—equal to load per tire on a big jet. The vehicle speeds down a runway through an area of controlled debris consisting of nails, bolts and broken concrete which can cause damage. Objective of this test program is to test wear, cut resistance and other dynamic conditions, and evaluate new designs.

This is the first vehicle ever made to test aircraft tires under actual airport conditions. Thorough research of this type is one of the reasons B.F. Goodrich is the leader in aircraft tires—and has pioneered with tubeless tires, new designs, and new materials. Speedy BFG lab tires you can depend upon. The B.F. Goodrich Company, Aerospace and Defense Products Division, Dept. AH-12, Akron, Ohio.



Examination of durability tested tire under actual runway conditions. Different types of aircraft

Supersonic Transport Stakes

Final approval of the Anglo-French supersonic transport program (AW Dec. 3, p. 41) came as a surprise to many people in this country who regarded this month published effort as a paper program that would never develop into a flying machine. We changed our mind about the solidity of this program either in the fall after talking to many of the technical people involved on the British side of the program. It was obvious then (AW Sept. 17, p. 34) that a great deal of substantial wind tunnel and engine development work had already been completed on both sides of the Channel and the technical managements involved in both countries were engaged much more heavily than any paper parameter studies would warrant.

Thus the formal signing of the Anglo-French agreement last month to jointly finance building two prototype and two preproduction models of the Mach 2.2 Concorde transport serves as single warning that this effort represents serious competition in the race to sell this type of transport in the international airline market. They are tackling a goal well within the technical capability of the team since the Concorde B-56 has demonstrated Mach 2 cruise performance as a standard operating procedure. Aerodynamics and engine development will require no brand state-of-the-art advances to bring the Concorde into active service, although this will represent a design and production achievement requiring the top talent of both countries. Despite all of the augmented walls of airline executives in Dublin, and the stern admonitions of IATA's Director General Sir William Hildred, there is no doubt that a supersonic transport will be readily available to the international airline market. Every major technical advance in the world has had its Sir William wringing their hands during its gestation period. The history of technology has shown that despite their wailing program contractors in reasonable reach forward.

Definite Market Value

We think that a transport that can cut present travel time between major stage lengths around the world in half will have a definite market value. Once its performance has been demonstrated during initial flight testing, passengers will be eager to buy a ticket to utilize its speed. The price that awaits success in the supersonic transport race is a large enough slice of the international airline market to make this a profitable venture.

The fact that the Anglo-French Concorde is off to a solid start with a technically desirable plus, however, does not yet insure this success. Experience has shown what a vast difference there can be between being first into

the market with a new technical development and arriving later with a much sounder product. The British consequently sponsored postwar jet transport development with the Concorde I. They were the first to put a jet transport into active service with BOAC's London-Johannesburg route in 1952. The Soviet Union was the second nation to put jet transport into active service with its Tu-104 transport on Aeroflot in 1956.

The first Boeing 707 jet transports were not delivered to customers until late in 1958 and were not really seen on the airways in any significant numbers until the next year. Yet today the Boeing 707 is the most widely used jet transport in active service around the world. Boeing has cut the largest slice of the subsonic jet transport pie selling more than 474 planes of this basic design. In contrast, the Comet fleet operating today numbers less than 100 and the Soviets have failed to sell the Tu-104 in any competitive market despite strenuous efforts to do so.

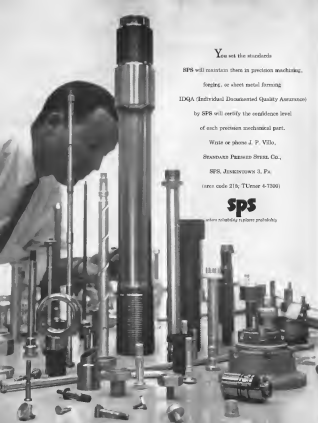
So it is not just over grapes when U.S. manufacturers move their purpose is not to be just first in the supersonic transport race but to be "first with the best." This is a policy that has paid ample dividends in the past.

Soviet Competition

The Anglo-French Concorde has a chance to be both first and best in the supersonic field. Its initial competitors to be the first will probably come from the USSR where a supersonic transport is in the works, although little is known about its design goals in development program. The lack of Soviet success in selling its transports in the now inactive airline market has been due to basic defects in the Soviet policies on production and competitive economy, rather than any lack of technical talent in its aircraft industry. We doubt that this major score transport will be any more successful than their turbojets and turboprops since the systems that produce them have not corrected its flaws.

Real competition for the Concorde will be the best will come from this country if and when a firm decision is made to begin supersonic transport development. The government has been supporting a modest research and development program in this area and at least four major aerospace manufacturers have been devoting considerable technical resources to exploring this area. But as yet there has been no firm decision on either the direction the U.S. supersonic transport program should take or the pace at which it should move. Hopefully both of these decisions will be made as part of the Fiscal 1968 federal budgeting process that should come to fruition next January.

—Robert Heitz



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WHO'S WHERE

In the Front Office

Prime & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn. An aerospace laboratory administrator, **Arthur E. Smith**, executive vice president, **Bernard A. Schoenfeld**, vice president-engineering, **James S. Lee**, vice president-marketing, **Bert J. McMenon**, vice president product support, **Richard T. Buehler**, engineering manager, **Richard J. Carr**, engineering manager, **Philip E. Kuehn**, and Development Center, **Walter Dell**, general manager-CANEL (Contractor Advanced Nuclear Engine), **Lawrence J. Lancia**, **Franklin**, general manager-transport and ground equipment, **UD's Hamilton Stead**, **Debra**, **Walter Lott**, **Conn.**, his assistant, **Charles T. Taylor**, executive vice president, **Ernest C. Carver**, vice president-marketing, **David G. Bain**, vice president engineering, **Robert G. Timbrell**, executive, **Anthony J. Deschamps**, general manager-ground support equipment department and general manager industrial products department, **Walter E. Smith**, general manager-electronics department, **John P. Sullivan**, general manager-transport and repair department, **UD's Stanley D. Connors**, **Conn.**, his assistant, **Ernest J. Greenwood**, vice president operations, **Will M. Linn**, Jr., vice president engineering, **Thomas P. Hulse**, vice president sales and service, **Mike L. Vardi**, controller, **Lawrence M. Lusk**, vice president manufacturing, **Reese Armstrong**, **Co., San Diego, Calif.**

George W. Dick, executive vice president, **CE-18, Inc., Washington, D.C.**

John White, **Technical Board**, **FSM**, **ret.** has been named Deputy Associate Administrator for Defense when a newly established position in the National Aeronautics and Space Administration.

Major J. Russell McCordle of London, England, has been appointed to the post of permanent Commissioner of the International Air Transport Association to judge breaches of the regulations of the aviation and related traffic conventions.

Honors and Elections

William M. Allen, president of The Boeing Co., has been elected chairman of the Board of Directors of the Aerospace Industries Ass. for 1965. **Donald W. Douglass, Jr.**, president of Douglas Aircraft Co., was elected vice chairman. Elected to the Board of Governors' Executive Committee: **Marvin Allen** and **Donald J. L. Stewart**, chairman of North American Aviation, **Malcolm F. Ferguson**, president of The Boeing Co., **Carl G. Holbrook**, executive vice president of Sperry Rand Corp., **John A. Kiehl**, president of Aerojet-General Corp., **E. Clinton Tiedt**, president of Convair Aircraft Engineering Corp. and the president of AIAA office for a second.

Dr. Hugh L. Dryden, Deputy Administrator of the National Aeronautics and Space Administration, has received a 1965 Jocko (for Public Service Award) in the field of science, technology and engineering. (Continued on page 120)

INDUSTRY OBSERVER

► **Free-Ping** is the name for a small, potentially responsive reconnaissance and surveillance rocket being designed by Lockheed Martin & Space Co. in conjunction of Army Signal Corps procurement of an electronic low-altitude communications/infrared system. Free-Ping would replace the more expensive and recently terminated USD 5 surveillance drone program (AW Nov. 25, p. 35). Free-Ping vehicle would have sensors at both ends enabling it to achieve for a return to friendly territory.

► **Watch for Senate** Preliminary push into action for heavy lifting of the Ministry of Aviation civil service into greater volatility. In past 10 years, more than 60 members of department-head rank or above have left the Ministry. Opposition Labor Party wants legislation aimed at restricting top-making civil servants from entering private industry for two years after leaving government posts.

► **Difficulty in solving** the problem of the severe boom in supersonic transport operations has directed serious attention to the low supersonic speed range as a possible alternative. Several manufacturers are studying the characteristics of a transport designed to operate at about Mach 1.2 as one way of avoiding the new noise limitations expected at higher speeds. One problem now will be in wood-natural forming the cruise Mach number lies within the transport range where flow characteristics make acquisition of test data difficult.

► **Air Force Space Systems Division** is making serious work toward ability to design and build polished plasma engines to be tested on ballistic rocket flights.

► **Aerospace companies** are expected to submit bids by Jan. 7 for Air Force's space communications and tracking subsystems and flight test program (AW Sept. 10, p. 31), expected to lead ultimately to a complex for manufacturing and controlling all types of Air Force earth-orbit satellites. Bids probably will include General Dynamics/Astronautics, General Electric, Hughes Aircraft, Philco, Radio Corp. of America and Space Technology Laboratories.

► **Snapp-BMA**, nuclear reactor and thermoelectric power conversion system designed to power 700 watts, is scheduled to be flight-tested late next year. Vehicle will be an Air Force Agnus II, tests will be conducted under a program previously known as Snapplet. North American Aviation's Atomic International Division is supplying Snapp-BMA under contract with the Atomic Energy Commission. Lockheed Martin & Space Co., which will integrate the system with Agnus II, is assigning the greatest emphasis to requirements for isolation measures of sensitive equipment in the equipment (AW Oct. 8, p. 23).

► **Grumman Aircraft Engineering Corp.** is preparing its WFF Hawkeye to the Air Force in an airborne warning and control aircraft. Grumman earlier proposed a conventional-based version of the WFF to the Navy. In carry 25 passengers or 99 troops over a 3,400-mile air range.

► **Strategic Air Command KC-135** tankers will be delivered without the usual emergency paint markings on vertical tail and fuselage nose. Strakes have been considered but the paint does not contribute significantly to the safety of in-flight refueling operations.

► **Boeing Co's Wichita, Kan., facility** is modifying a B-52 to be another plane and transfer for initial free-flight tests of the D-1550. Air Force glider vehicle will be used for aerodynamic stability tests and pilot checkout in transition from the B-52 before being hoisted into space with the Titan 3 (System 62A) booster. Modifications of the B-52 may be completed by April, 1967.

► **Avionics Control and Measurement Agency** plans two new research study programs, one dealing with requests to volunteer of agencies and the other covering the role of ground-inspection teams in detecting unannounced aircraft production activities. Industry proposals on the first are due Jan. 5, on the second, by Jan. 15.



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Washington Roundup

Ranger Review Ends

Report on the findings of NASA's in-house review of the Ranger lunar spacecraft program (AV Oct. 29, p. 58) was completed Dec. 7, and although it is somewhat critical of Jet Propulsion Laboratory's management of the project, it concludes events will not change should continue, and under JPL's direction will have a chance for substantial better details of the report are given to Congress or made public. NASA's new man based varied subcontractors and spent a week at JPL during its five-week study.

JPL hopes one result of all this will be a clear, written definition of the division of responsibilities between itself and NASA headquarters, which it feels has been lacking.

Federal Aviation Agency is debating whether to propose legislation spelling out its authority in helping to reduce aircraft noise. Some FAA officials agree that would be better than letting Congress define the authority for the agency. Several bills aimed at giving TAA and noise responsibility failed to pass in the last Congress.

A2F-1 Cost Under Fire

Cost to effectiveness argument is threatening to cut short the Navy's Crusader A2F-1 attack aircraft program as Fiscal 1964 budget-making enters its final stages. Navy is authorized to buy a total of 65 with Fiscal 1962 and Fiscal 1963 money. It considers the A2F-1, which combines take, takeoff and superpowered growth on a display to permit all needed attack, a highly sophisticated aircraft. Initial unit price was \$6.75 million in Fiscal 1962. This has now dropped to \$4.54 million, but analysts in the Defense Dept. consider this too high.

As Fiscal's Stollhoff has launched ballistic missile system is being attacked both on cost-effectiveness (AV Nov. 26, p. 27) and on the argument that the first satisfactory attack capability will not pass to intermediate ballistic missiles. This argument says that IC-BMs would clear even intermediate-range missiles in use of the nations of the Stollhoff and allow 3-12 aircraft to fly to their targets with nuclear bomb loads. As Fiscal questions that Stollhoff provides a much more flexible response than a ground-based ballistic missile.

Lower reliance in the Air Force are serving a proposal to strap two Thorad missiles to a Douglas Thor to provide a relatively cheap booster for such payloads as the Bureau reconnaissance satellite. The booster would be called Thorad.

Federal Labor Policy

Important policy questions has been posed on whether the special labor commission appointed by President Kennedy to advise each department during construction of new federal workers' union, including who should extend its jurisdiction to federal and state and National Administration and State Administration institutions of other types.

John E. Kennedy, executive secretary of the President's Manpower Labor Commission, and Defense Dept. has asked the commission to help more labor management relations at civilian and military sites and NASA has indicated that it may consider an executive order in Washington, Ala. and Michigan, La. The commission, chaired by Labor Secretary W. William Wirtz, was due to meet on the subject at its Jan. 17 meeting.

Basic issue is whether expansion of the commission's role would lead the government deeper into labor-management relations before a need is demonstrated. Wirtz is more deliberate than his predecessor, Arthur Goldberg, and may resist extending the commission's jurisdiction at this time.

Max Goldfarb, Air Force general counsel, will leave the Pentagon around the end of the year after 14 years as USAF's assistant general counsel. He is the assistant secretary for external and chief legal officer. Goldfarb told AVIATION WEEK & SPACE that he is leaving for financial reasons, and has not yet decided whether he will practice law or take an aerospace industry post.

Canaveral Helicopters

Use of helicopters to get tired men in the Cape Canaveral area is under study by NASA. Sixteen C-5 and Navy aircraft and transport into the 20 to 35 ft. from aircraft at Patrick AFB, Fla., and Cocoa Beach. Helicopters also could be used to land personnel from an aerial point at Orlando and Melbourne. NASA would not buy the helicopters. Service would be provided under contract, if NASA decides the saving is worth the cost.

Latest anti-statements on antinuclear missile comes from Paul H. Nitze, assistant secretary of defense for international security affairs, in testimony released recently by the Senate Propaganda Subcommittee. He said "a far effective anti-nuclear deterrent" was not "in the cards for them [Russians] nor for us within presently foreseeable technology." Nitze's statement and related testimony will further development of nuclear experience, will give development of anti-ICBM, he said.

—Washington Staff

Urgent COIN Aircraft Program Planned

Bids will be asked by Jan. 1; \$100,000 glass-fiber counter-insurgency vehicle would have turboprops.

By Larry Woods

Washington—Industry will be asked before the end of the year for proposals to develop and produce an "anti-burn" aircraft, a reborn scout, glass-fiber counter-insurgency (COIN) aircraft. It would be used by the U.S. but would be intended primarily for small nations faced with communist attacks. Target cost of the aircraft in quantity production has been set at \$300,000 each. No final decision has been made on which service will be given management responsibility, but it appears that it will be given to the Navy.

Specifications will require that the aircraft be powered by two turboprop engines of about 1,300 shp each, be able to operate from a 500-ft airstrip over a 90 ft obstacle, and be adaptable for operations from the water. It will have a crew of two. Target weight is 3,500 lb empty and wing area is 20 ft².

Target missions would be a 40-lb target payload on a 60-lb payload power off. Maximum speed desired is between 250 to 300 kt.

Reason for the issue of weapons is the need to replace the relatively low performance aircraft now being used in the present situation. No aircraft now in production is considered capable of fulfilling the counter-insurgency role. The contractors will call for already developed components. The only materials will be a statement that it is desired that the basic construction of the airframe exterior be glass fiber to reduce weight and increase strength. Airframe requirements limit the navigation and target location equipment to radio and low-light-level television.

Night Actions

It is estimated that 90% of all night actions take place at night. During the night, the aircraft is vulnerable to an attack, take off and land for darkness is no longer a factor.

In the end of the counter-insurgency role, the aircraft is not to provide enough weapons. The standard mission would involve going to the front line area, landing on a strip to pick up an observer equipped with the arm, proceeding to the action site and making an attack at low level. Since the aircraft is in Southeast Asia, the aircraft probably would be used first in the mountains. The aircraft is a low-altitude aircraft and can be used in areas that are hard to land.

The specifications will call for a low frequency radio which will be reduced from the microphone, coming in a form of a microphone. The aircraft is a low-altitude aircraft and can be used in areas that are hard to land.

It is estimated that 90% of all night actions take place at night. During the night, the aircraft is vulnerable to an attack, take off and land for darkness is no longer a factor.

A Defense Dept. official emphasized that no technical breakthrough will be necessary in developing the aircraft. The main consideration in writing the specifications was to ease of maintenance. Glass fiber is easier to repair than metal. Electronic equipment could be replaced on the field and later repaired at a central location.

There are about 1,000 of the "T" and "L" for transport and transport-light aircraft in use across the U.S. today. Most are 15 to 20 years old.

A lot of use in South America and Africa. These light aircraft are in use in military action against guerrillas and are used for training of guerrillas. The aircraft are used in the field and later repaired at a central location. There have been suggestions in South America that the aircraft be used in the field and later repaired at a central location.

When the situation in South America gave rise to such proposals that the supply of aircraft be increased and the aircraft be used in the field and later repaired at a central location. There have been suggestions in South America that the aircraft be used in the field and later repaired at a central location.

Military Corps Studies

Recently, the specifications that will be given to the contractor. The contractor is expected to develop a design for the aircraft. The contractor is expected to develop a design for the aircraft.

The specifications for the counter-insurgency aircraft do not call for the capability of making output in the field. The aircraft is expected to be used in the field and later repaired at a central location.

Revisions of the specifications. The specifications have been revised to call for a low-altitude aircraft. The specifications have been revised to call for a low-altitude aircraft.

Cape Canaveral—All phases of advanced ballistic missile nose re-entry-land use materials to transport payload. The nose re-entry-land use materials to transport payload. The nose re-entry-land use materials to transport payload.

Total of 12 contractors, including Armstrong, Aero, Bids, Chrysler, General Dynamics, General Electric and Hughes, will participate in program, called ARIES (the advanced ballistic missile re-entry system). Project costs have been charged to the Air Force.

New materials will be used to transport payload. The nose re-entry-land use materials to transport payload. The nose re-entry-land use materials to transport payload.

Materials will be used to transport payload. The nose re-entry-land use materials to transport payload. The nose re-entry-land use materials to transport payload.

Deeply and other protection also such as an armor plating to protect with tracking of the nose by an anti-missile radar. Although the primary purpose of the ARIES program is to develop a nose re-entry-land use materials to transport payload. The nose re-entry-land use materials to transport payload.

Administration to Ask \$6 Billion for NASA

By Edward H. Koleson

Washington—Kennedy Administration plans to submit a \$6-billion fiscal 1967 budget for the National Aeronautics and Space Administration.

Congress is expected to act on the coming NASA budget request. The request is expected to be a \$6-billion budget for the National Aeronautics and Space Administration.

Let's wait, President Kennedy still had under consideration a \$125-million supplemental budget request for the space agency, despite NASA Administrator James H. Webb's public statement that a supplemental request will not be made (ENR Nov. 19, p. 26).

Chances are considered that, however, such a request may go through because both Administration and congressional leadership agree that the

agency needs the funds now, and not until March or April when Congress would probably approve them. As a result the fiscal 1967 budget request has grown from \$5.5 billion to \$6 billion. The request is expected to be a \$6-billion budget for the National Aeronautics and Space Administration.

The 1967 budget, if it is passed, would be a \$6-billion budget for the National Aeronautics and Space Administration. The request is expected to be a \$6-billion budget for the National Aeronautics and Space Administration.

Budget Bureau and NASA are currently negotiating the fiscal 1967 space budget, and it is not clear if the request is a \$6-billion budget for the National Aeronautics and Space Administration.

During a discussion on the budget request, the President, Webb and DeLoach, NASA's second space flight administrator, agreed with DeLoach that the program has the highest priority in NASA.

Chances to flow in the program will be of completely new design, with other modifications of generally applicable. The design is a 4-1/2 ft vehicle, which may be an even extended consideration between the two groups. Some ARIES vehicles are expected to be lighter than the standard payload weight required in Atlas for launching light vehicles and consequently will be lighter. Re-entry vehicles with varying lifting abilities, as well as fixed vehicles, are considered to be useful.

In addition to the ARIES costs, much launch vehicle will carry at least one and possibly several payload vehicles on the side of its airframe. Available resources for these pods will be provided by USAF contract and other government agencies such as the National Aeronautics and Space Administration or the Atomic Energy Commission.

Between 20 and 30 General Dynamics/Astronautics-built Atlas F rockets will be used to fly ARIES craft. Most will be flown over Atlantic Missile Range. First flight is expected later this January. Although the Atlas was scheduled to launch in January, launch and development flight test program has been postponed to 1967, the first ARIES launch will carry the second amount of missile instrumentation, since they were on the production line before the decision to use the light test program. All test flights will be carried out by the ARIES.

ARIES is a more extensive continuation of a re-entry system that began several years ago with the Lockheed-built X-70 rocket (ENR Feb. 4, 1967, p. 27). Advanced entry materials and techniques have been explored in earlier X-70 flights but always on a secondary basis.

Vice President Johnson, Webb, Helms, Associate NASA Administrator Robert C. Stevens, Jr., and DeLoach and C. Webb, executive secretary of the Space Council, have been in fairly close contact with the agency in the past few months regarding the coming budget request and its effect on future programs.

Questions under discussion by the group and the Budget Bureau concern programs other than manned lunar landing. Among them are nuclear reactors and rocketing space nuclear power. A fundamental issue which has been raised is whether U.S. will proceed independently with nuclear reactors and technologies, or wait development of technology before going into active hardware programs.

Other unsettled questions which could affect the fiscal 1967 program are the current of operations of NASA and Defense Dept. development effort in man-in-space satellites and other of the large construction programs can be delayed without affecting the end date schedule for Apollo lunar flights.

Because such projects in Ranger and Surveyor are expected to contribute directly to Apollo, the Administration considers that funding for a part of their development and flight is a part of the Apollo program. The Apollo program is the highest priority in NASA.

U.S., USSR Approve Joint Space Tasks

By Wad Wright

New York—U.S. and Soviet governments have formally approved three joint programs for the peaceful uses of outer space. Programs grew out of bilateral talks between Dr. Hugh H. Dwyer, deputy administrator, National Aeronautics and Space Administration and A. A. Blyustov, vice-president of the USSR Academy of Sciences, held in Geneva, Switzerland last June.

Joint programs, which grew out of a March, 1961, exchange of letters between President Kennedy and Chairman Khrushchev, were discussed last week by Adlai E. Stevenson, U.S. ambassador to the UN, in a General Assembly committee meeting convened to consider adoption of the report of the Committee on the Peaceful Uses of Outer Space.

UN observers monitor the acceptance and approval of U.S. Soviet cooperative space programs in an indication of easing East-West tensions. President Kennedy and Premier Khrushchev approved the programs outlined by Dwyer and Blyustov. One a year later the resolution for approval had been introduced by the Cuban vote.

The three programs are:

- Meteorological research to be conducted in two phases.
- World Geographical Survey to take place during the period of the International Year of the Quiet Sun (1958).
- Satellite telecommunications experiments.

First or experimental stage of the cooperative meteorological research program, will extend from approximately the present time through 1963-64. During this period, U.S. and Soviets will continue development of experimental weather satellites.

Joint Working Group of experts will meet in the near future to arrange an exchange of data for the transfer of data gathered from the experimental satellites. These talks would concern the World Weather Center established during the 1957 in Moscow and Washington. Working group also will consider joint sharing and the interests of other nations in the program.

Group will establish criteria for the transfer of satellite data which will include selected cloud cover photos, especially those related to storms, hurricanes and their origin. Geographical coordinates and cloud analyses also will be included in its transfer of data.

Data will be shared upon to the group for entering weather data from its when the two countries are prepared to exchange data of experimental interest. The group data links will be used to exchange weather charts, diagrams, vertical cross-section and other material needed for solving world weather problems.

Second, or operational stage of the program is scheduled to begin in 1964-65 with the coordinated launching by the two nations of a system of operational weather satellites. Weather data transmission will be on a real time basis.

Joint working group is scheduled to meet next spring to agree on launch schedules for the experimental satellites, their numbers, orbits and compatibility of their sensors.

These discussions will give due consideration to World Meteorological Organization (WMO) weather data collection goals for operational and research satellites.

Preliminary work for a world geosynthetic survey will be handled by an other joint working group of specialists which would consider technical aspects of mapping the world's magnetic fields with artificial satellites. This group will formulate recommendations on the stage of orbits, type of satellites, in the equatorial, periods of satellite operation, accuracy of measurements, type of instruments to be used in the satellites, methods of processing and storing data and other details. This group is scheduled for appointment in June at Moscow.

Program will involve a coordinated launching of two satellites equipped with spectrometers during the period of the 1958. Satellites will be launched on different initially agreed orbits. Period before 1958 will be, and both countries to conduct their own magnetic measurements in space with a mutual exchange of measured data.

Data gained from scientific measurements will be exchanged through the World Data Center in Moscow and Washington, established during the 1957. Both nations have agreed to use

Navy Asks TV-Guided Missile Appropriation

New England—A pending appropriation of funds in Fiscal 1964 budget for development of a television-guided, air-to-surface missile, the ComNav (AW, Apr. 9, p. 31) possibly intended for use as a successor to the McDonnell F4H and the North American A-7 and possibly the F-110B.

Some congressional sources also include investigating various elements of the service. North American Aviation's Columbia Division has been running simulation studies under contract from the Navy's Bureau of Weapons and Naval Division of Norfolk Corp. in conducting extensive studies of the data system which is intended to link the missile with its launching platform over a range of up to 180 mi. Other companies which have expressed interest in the weapon to BuWeps include Martin Co., Douglas Aircraft, General Dynamics/Ford and Long Trencher Yeager.

ComNav wants to be guided by its target by the pilot of a launching aircraft from a visual sighting distance, programmed by a missile. The missile would be launched from about 40,000 ft. Also taking about 200 ft. in propulsion would require. In proposed range is considerably longer than that of the right guided air-to-surface Balogh missile. Tailhook arrangement for the project suits with the Naval Air Development Center, John F. B.

Should the Navy be successful in getting the desired funds in Fiscal 1964, industry may be invited to participate earlier, perhaps in this group. The most development focus—whether Navy will select a single project or a series of missiles—has not been finally determined.

Navy agencies have been evaluating various concepts of the missile, for some time particularly the guidance tracking and guidance control. One of these calls, Wilbur (AW, Apr. 9, p. 31, Oct. 15, p. 28), looks into a target selected by the pilot from his display of range measurements made by a camera in the air launched missile. This system was developed at the Naval Ordnance Test Station, China Lake, Calif. A somewhat similar one has been under development at the Naval Test Facility, Ft. Meade, Md.

ComNav wants to be guided by its target by the pilot of the Naval Ordnance Test Station, China Lake, although such of the original work as it began at the Naval Ordnance Laboratory, Corona, Calif.

a robot system controlled to do so by the four sets. He outlined the UN space committee recommendations for improvement in distribution of weather information gathered by satellites, and mentioned the U.S. and Soviet weather satellite programs. Neither, he said, could furnish weather information around the world to an acceptable ground station such as NASA's Automatic Earth Transmitter receiver (AET).

This system, ComNav said, would cost about \$50,000 and enable interested nations to receive direct transmission of local cloud cover.

Atlantic Research

Management Changed

Top management of Atlantic Research Corp. has been reorganized, and Dr. Arthur W. Sloan, former head chemist, has been elected to the new post of chief executive officer.

Atlantic's change of a five-year improvement in the trading of Atomic Research Corp. stock (AW Nov. 26, p. 97), redesignated the company representative to Congress.

Dr. A. C. Seabold, who was president, became chairman of the board and will devote primary attention to the technical progress of the company.

Dr. Sloan became vice chairman of the board and chairman of the executive committee as well as chief executive officer. He will be responsible for overall policy matters and for financial direction of the company.

Mr. Sloan, former president and a board member with responsibilities for general management of the company's day-to-day operations. He is vice president and has directed corporate programs in solid propellant rocket development and also in vehicle system engineering.

Soviet Circumnar Plan

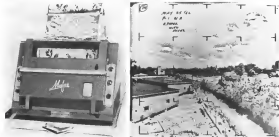
Washington—Soviet Union's Space Missions and last week that Soviet Union plan to place in orbit two man-made orbiting stations.

Moscow made its report after meeting in Moscow to inspect a Soviet-built 11g rocket engine on which Soviet plans in training and to attend a USSR Academy of Sciences meeting.

Soviet Embassy here told Anatole W. W. and Space Technology the device was built by the Soviet Union, the Soviet electrical components manufacturer in the country.

Announced in Moscow, about 100 mi. west of Moscow.

At the same time, a Soviet satellite announced the construction of a station in Russia a year ago.



AUTOMATIC PICTURE TRANSMISSION (APT) system is expected to have wide application in weather and information forecasting. The system is planned for use in Moscow automatic weather, although preliminary flight test may be conducted in 1963 with Fire. Cloud pictures can be taken when satellite is within 1,170 mi. range of moving station. Photos will be received and reproduced automatically from satellite transmitters on operational observation paper.

CANEL Aims for Snap-50 Test in 1965

By David A. Anderson

Midwest, Corp.—Fabricator of air, elements and the ammonia and gas used for a lightweight, expensive 14 reactor leading to the Snap-50 reactor has begun work at the Connecticut Advanced Nuclear Engineering Laboratory (CANEL).

Other components of the reactor have been produced and three 40% of the detailed engineering fabrication drawings have been issued to the shop. Design of the reactor is essentially complete.

Current schedule calls for assembly of the reactor to be performed in 1964 at the Atomic Energy Commission's Idaho Falls reactor. Considerable experience and testing of the liquid-circuit systems will be done first year and in 1965, according to the same schedule. Part of Whittaker Aircraft Division's

United Aircraft Corp. is responsible for the design and development of the high-weight prototype reactor for the Snap-50 reactor system, which design is known as P.W.A. development in the non-nuclear reactor system program. P.W.A. also operates the government-owned CANEL facility for the AEC, under a contract for research and development work, approximately \$22 million in fiscal 1965.

Snap-50 is a lithium-cooled reactor system for space electric power rated at design power levels between 300 and 1,000 kw, and specific weights between 20 (for the 300 kw, LAL) and 1015 (for the 1,000 kw level). The weight goal would include the radiator, and one of the elements in this and any other power source program. P.W.A.'s responsibility does not now include the design development or production of the radiator.

Snap-50 and its prototype system start with the design process of highly enriched uranium fuel generated in elements in a liquid metal reactor. The reactor is cooled with liquid lithium, a non-oxidizing metal with high thermal conductivity. The liquid lithium is the coolant. The liquid lithium is the coolant at approximately 2,000° at which temperature its viscosity is approximately that of water.

This characteristic of lithium makes it possible to cool low temperatures at low flow rates, which is clearly desirable, and considerably easier to handle than sodium lithium at 2,000°.

Lithium is contained in a primary loop which leads from the reactor to a boiler, where the heat from the lithium is used by a heat exchanger to boil potassium metal in a secondary loop. The lithium leaves the boiler, passes an accumulator, and through a pump and back into the reactor area.

Viscous potassium heats the boiler and enters an expansion turbine which takes energy from the hot vapor. The turbine drives a generator and its generator produces the electrical power which is the main purpose of Snap-50.

Immediately downstream of the turbine is the potassium pump. Like the sodium pump, it is electrically driven by power tapped from the generator output.

Potassium in the vapor phase, with from the turbine and pump through a heat exchanger which cools it to the liquid phase. Its heat of condensation, stored during the condensation in a discharge during the condensation. The liquid potassium passes through a secondary radiator for further temperature reduction, and is then used as a coolant for the generator and other system units. It is returned to the upstream side of the boiler unit to repeat the secondary loop cycle.

Lithium contained throughout the system is performed with an alloy of aluminum and cobalt, copper, silver, and other components are fabricated from this alloy. Typical parts have been operated for 10,000 hours at temperatures up to 2,000°.

Current reactor design will be followed by an advanced reactor for the Snap-50 system will be performed in a test loop for 16,000 hr of operation in a space environment.

With total system weights between 6,000 and 10,000 lb, the Snap-50 reactor is scheduled for flight tests in vehicles of either the Titan 3 or the Saturn class. If present schedule are met, flight tests should be made before 1970.



MOCKUP REACTORS (above) are used in controlled-flight experiments at CANEL. In "hot" laboratory (below) operators work with subcritical methods assembly.



General Dynamics F-111 Organization

First Work, Ten-Imported organization changes have been made by General Dynamics/F-111. Work in acquisition and specific development of the recently won development competition for the F-111 multi-role fighter (SW DC, p. 26).

Post-work acquisition is being set up in the new program, says F-111 President Frank W. McCallister. Shaded by S. T. (Don) Conley, newly program director for the upcoming B-1B bomber, the acquisition director, William C. Dierks, F-111 deputy program director and chief engineer Bill C. Webb, program contract administrator, Norman H. Sargent, quality assurance director, Ken Colquhoun, planning and control manager, E. S. Brown, F-111 production control manager, Robert K. Kline, technical manager, Warren B. Talbot, simulation manager, Robert W. McCallister, logistic support manager, Robert W. Miller, F-111 test manager, F. E. Hinkley, Canadian aviation manager, George J. Dixon, aviation manager and other contract members, and A. S. Mitchell, S. C. assistant for technical requirements.

Initial contact with the General Dynamics/F-111 Work-Group team will be for 12 of the previous F-111 fighters to be built here for development testing, with additional aircraft added within months thereafter.

USAF C-130As Accelerate Airlift Of Arms, Troops to Assam Valley

By Cecil Rowland

New Delhi—Twelve U.S. Air Force Lockheed C-130A transport aircraft on loan to the Indian government are padding infrastructure and area into the threatened Assam Valley on an aerial and land, with each aircraft and crew being an average of six weeks per day.

In late last week, the aircraft were scheduled to have landed a total of approximately 6,000 troops and well over a million pounds of equipment into Assam from New Delhi's Pooni Airfield from the time the C-130A with troops in transit on Nov. 20.

Series, with USAF assets already on being conducted under the direction of Indian air force headquarters here and continuing despite the continued cease fire and partial withdrawal of Chinese recent Chinese troops along the Himalayan border area of Ladakh and the North East Frontier Agency (NEFA).

Government Position

The aircraft, from the 32nd Air Division based at Everett, Wash., have not yet begun to operate into the high-altitude fields of Ladakh and NEFA, although there are expected to begin flights into these regions with the new force. Only U.S. government position attributed to the emergency, loss of the aircraft to India is that they are not new when they might be exposed to direct Chinese fire, possibly creating an international incident at major proportion.

That fear, there has been no indication that the Indian government plans to declare its troops in the area of the C-130As and regular Indian air force

aircraft is reported for the 32nd Air Division aircraft is being established from direct on the supposition that the planes probably will be called upon to remain here, even a prolonged period.

Individual aircraft have lifted up to 100 troops on the five-hour flight from New Delhi to Assam, although officials say the maximum design load for the C-130A. Cargo carried has been primarily in the form of individual weapons, munitions, rations and ammunition plus support equipment.

Biggest push came during the first few days of the late when over 4,800 troops were carried into the two high-altitude Assam fields assigned to the C-130A. The entire series were alerted for the mission on Nov. 21 and by 1 p.m. on Nov. 23 all 12 plus a support C-130 had completed the 3,800-mi trip to New Delhi, bringing with them a full 30-min supply of space, maintenance, medical, radio, food and fuel. Including 12 of aircraft crews, a total of 205 men are now stationed at Pooni for the operation.

Fuel for the operation, P-4, is being supplied from Indian air force stock. Supply at the moment is said to be plentiful, although the could change if the combined C-130/Indian air force airlift operation continues at its present pace. There are no facilities for refueling P-4s within India, and this fact must be considered here from inside the New and Middle East. There also is a shortage of fuel cars needed to transport the fuel from dock areas to air force packages.

There are no flight schedules in the C-130As and 32nd Commander Gil Charles Hovey directed that one

aircraft be grounded each day for a full maintenance check. It is anticipated of a prolonged operation in India. Hovey also ordered that a probable return for aircraft and crews be put into effect last week.

Under the plan, one aircraft and its crew will operate in Assam each week with its maximum flying to New Delhi with additional space and other efforts to support the Indian air force to get the aircraft back.

The C-130s made the flight from Tezpur to Pooni in a total elapsed time of approximately 29 hr, including a five-hour stop in Tezpur.



ANNA Tracking

Flashing light on ANNA portable aerials was recently photographed during recent operations test of the satellite which is administered by Army, Navy, Air Force and NVA. Photos were recently prepared at Johns Hopkins Applied Physics Laboratory and were photographed by the Ballistic Research Laboratory's station at Apsara, India, Chongqing, China. Each photo represents one million with power output and lists about one ten-thousandths of a second with an interval of 36 sec between flashes.



Russian Ship Begins Return Of Il-28 Bombers

Three barges of B-30 Bepko pre-painted light bombers are visible on the deck of the large Russian cargo ship Olenok leaving Cuba. The ship was photographed in U.S. reconnaissance aircraft on southern coast of Cuba Dec. 1. LHA returning Russian mail-carrying ship (AW Nov. 5, p. 31). The Olenok, shown considerably full, takes the water line indicating light loading. Cargo barge near the bow shows the hull number 10870, 10 ft long and is similar to that of the Poltava (AW Nov. 12, p. 32). Poltava is designed for rapid loading and unloading of special war cargo at ports without much dock equipment and except for limited deck Olenok's layout is similar. Note three large life Olenok's deck, including 10 ft of photo glass.



Three LEM Engine Contracts Due

Security was torn from Grumman Aircraft Engineering Corp. has been at work with National Aeronautics and Space Administration's Marshall Spaceflight Center in Houston under Dec. 5 to deliver the contract for the three engines module (LEM) and to select the list of subcontractors on the subject.

The LEM engines (AW Nov. 14, p. 26) will be used in last two Apollo missions in the moon and return them to the Apollo command module. A group subcontracted in the engine engines, propulsion, and transfer agreement has been reached between Grumman and NASA that three contracts will be awarded for these propulsion systems.

• Main engine, for lunar landing, will involve extensive throttling capabilities, and will be developed in two parallel programs, one using the existing engine technology (AW Nov. 5, p. 27) and another employing a radically controlled combustion engine. Evaluation of these two approaches, after prototype design would result in selection of a single contractor to develop the final engine, which would use an engine module of conventional design/development and produce Apollo systems into the orbit.

• Lunar island engine, for orbital use, and understanding with the existing Apollo systems, will involve a fixed-size injector, allowing limited throttling, approximately in the ratio of 8 to 1, for varying propellant flow. Propellant would be used in for the main engine.

Grumman as LEM prime contractor will manage the propulsion development for Marshall Spaceflight Center and is expected to award sub-contractors under the LEM program. Other contractors for the main engine are expected to be selected from North American Aviation's Eastern Division, United Aircraft's Global Technology Center, Aerojet General, and United's Rocket Motor Division. Bell Aerospace Corp. is the current contractor for sub-contract selection to develop the lunar island engine.

House Space Group Challenges Advent Program Cost Effectiveness

Washington—House Science and Astronautics Committee organized further hearings about the wisdom of pursuing the Advent satellite communications satellite program by declaring last week that the Defense Dept. satellite plan cannot be justified as a cost effective new lease.

The applications, tracking and data repository subcommittee reported in earlier House space subcommittee meeting Dec. 15 that "we can have an operational capability with this low altitude satellite in the latter part of 1964 or early part of 1965." The Hecker subcommittee questioned in its report whether it was wise to embark on the selected Advent program when a number of other satellite programs are in progress. Hecker's report said that "at least some satellites with far more capabilities and capabilities could be in operation."

The subcommittee report asked the Defense Dept. to provide "assurance that every advantage is being taken of previous development in the field of communications satellites" as well as "definite justification" of present and proposed Advent expenditures.

The House space subcommittee made a similar report in its report which was made public last month (AW Nov. 18, p. 117).

Decision Unit Urged For Nimbus Program

Washington—Nimbus weather satellite program should be reorganized so there is a "unit of effort" to settle differences between the Weather Bureau and National Aeronautics and Space Administration, the House Science and Astronautics Applications Subcommittee said in a report last week.

The relationship existing between the Weather Bureau and NASA, the subcommittee said, "is basically one of confusion, strongly implying that, in instances of an unusual conflict of judgment, there are no means of settling it final decisions after that at the presidential level."

The subcommittee recommended creation of a "court of appeal" from which final and binding decisions can be obtained.

The subcommittee report was based on hearings held Aug. 25-26 Sept. 21. The House Dept. witnesses at the hearings discussed the Nimbus launchings had slipped about a year from the original target date of the second quarter of October 1962.

Dr. Mervyn Tipper, NASA weather systems chief, said during the hearings that NASA was conducting the Nimbus program on an "as best as possible" rather than target-based (AW Sept. 3, p. 17). The subcommittee recommended that NASA make it clear that there is a need for agency in the Nimbus program. In contrast to Tipper, Dr. S. P. Maran, National Weather Service's Chief, said during the hearings that he was aware of the agency surrounding Nimbus.

Olympus Testbed Burns

London—Yves Valentin brother called for the British Satellite Olympus 32 E engine was destroyed by fire last week at the filter production plant.

Explosion was being used for ground tests when the fire started. Flaming fuel spilled over the pump, destroying a few engines. Three more are expected.

The Valentin, which caused the Olympus 32 E, was double under test firing, on the test bed (AW Dec. 15, p. 117) had completed about 180 to at eight test run. It will be several months before a new testbed can be constructed.

One of the Valentin will make a delta in the British 1983 delta engine—more aircraft program. A version of the engine which includes an extra stage, is under development for the post Anglo-French space program. Later engine is designated the Olympus 101. Component parts for prototype to give the new being ordered by British Satellite.

Boeing Expects Full Production In Transport Division for 10 Years

Remus, Wash.-Airbus traffic flow is conducted by Boeing Co. has commenced the manufacture of a full production line in its transport division here for at least another 10 years.

Production of its latest model, the short-haul 727 replacement transport (AW Dec. 3, p. 36) at a rate of eight planes per month after 1985, along with an anticipated production of three to four 720B medium-range transports per month until 1986-1970, is expected to give Boeing a new emphasis following withdrawal of the airline industry's commitments for long-range jets.

Boeing's family of 16 jet aircraft now ranges from the intermediate-sized 707-120B to the 747-200. Likewise, all scheduled airline needs with one class exception—a very short-haul local service airline jet transport.

So far, U.S. airlines have shown no interest in the Boeing-BAC 111 bypass transport for short-haul operation. Several carriers, notably American Airlines, are withholding any decision on this aircraft until Douglas Aircraft Co. decides whether to produce its proposed short-haul 738 transport.

Boeing considers the BAC 111, the Canadair and the de Havilland D211 Frequent its principal competitors in the sale of the 727. Nevertheless, it is not clear that it will sell a maximum of 900 727s in a market which, the company believes, will be at least 1,600 aircraft of the 727 type.

The firm's airline market forecasts issued in the late 1970s for the development of its family of jet aircraft. Essentially, the forecasted growth was developed on the theory that lower fares, which would generate new traffic, would be offset and that this new traffic would be able to open new markets.

The company admits that the optimism of its forecast is a direct result of the acceptance that lower fares, based on the higher production rate at present, would be rewarded by the airline industry instead of Boeing and its

very used and the forecast, therefore, is probably over-optimistic. With respect to the effect jets would have on traffic growth, Boeing applied its growth rate to the 1958 base, which it took as the earliest level of the advanced jet aircraft. It then assumed that present jet types will provide a new response to airline business until about 1967 "when the world jet potential will have been fully exploited."

It found that the domestic traffic growth rate between 1967 and 1987 will be between 1% and 5%, which 5 to 6% will be new growth and about 1% net and growth. The latter is based on the overall expansion of the economy and population, the former on the opening of new markets and the attraction of jet travel.

The manufacturer further assumed that the post-1967 generation of aircraft equipment, in turn, will spark traffic growth, although this ultimate growth rate will probably be substantially lower than in the preceding period, perhaps between 5 and 6%.

Boeing, per the conditions in the forecast, a prolonged economic recession would erode a considerable decline in air traffic, its recovery occurring only when the economy improves. It added:

"Once today, the airline industry is becoming increasingly reluctant to reduce fleet size, a typical indicator of sustained industries. From 1967 on, their vulnerabilities will be even greater."

Boeing finds that more often carriers have forecasted sales on a basis of "the market approach." In this connection, the manufacturer's forecast noted that the total domestic carrier fleet market has remained constant for a number of years.

The forecast also finds that a growing volume of air travel can be anticipated, which should force the carrier market to expand. In addition, the Boeing study notes that the airlines to continue carrier traffic instead, it does that conclusion.

"As travel has made steadily... into the automobile market to attract new business. Meanwhile, the automobile has caused airline losses of net and bus traffic."

In world air transportation, the Boeing survey indicates that a slowly declining rate of traffic growth can be expected during the next 10 years. In 1965, the world's airlines will have an average annual growth of about 13%. The forecast thus finds that the growth rate will dip to about 9% from 1969-1970 and to 6% from 1970-1975.

Foreign flag carriers and U.S. inter-

national airlines are expected to be 116 billion passenger miles in 1975, compared with the 37 billion passenger miles flown in 1961. The survey found that foreign and U.S. international carrier traffic has exceeded that of U.S. domestic carriers, and added:

"By 1968, foreign flag airline traffic is expected to exceed that carried on both U.S. domestic and U.S. international airlines. Foreign carriers will grow substantially and at a higher rate than U.S. domestic airlines. In its international forecast, started last year, Boeing was again considerably more optimistic than other similar forecasts undertaken either by Carsons, Canadian, International Civil Aviation Organization and Lockheed, which was the last optimistic of the group."

Boeing found that traffic growth on the plane North Atlantic routes was about 20% in 1975 and 1968 and about 9% in 1961. It forecast an average 15% annual growth, based on three studies for the period through 1965.

The company attributed the pessimism that prevailed among the airlines throughout 1961 to the rapid increase in a wide range of airlines, which was substantially higher than the increase in carrier passenger miles. It explained that it is not uncommon in an industry for a large increase in capacity to cause a corresponding decrease in load.

Improved personal incomes in Europe, coupled with the establishment of the European Common Market, is expected to bring traffic growth in long-haul air travel in Europe, the study found. It said that the European total passenger miles increased only 42% between 1950 and 1959, compared with a 125% increase in air travel on a regular basis.

Banks Group Forecasts More Airline Earnings

Significant improvement in airline earnings is possible in 1975, the Airline Industry Committee of the Air Transport Builders Assn. believes because capacity controls will be relaxed in Europe, and a small growth of traffic is expected to halt declining load factor (AW Nov. 19, p. 41).

"Load factor is declining," the committee reported to the association's executives last week. The airlines' load factor should continue to decline. New operating charges appear to have about reached a peak so that no further pressure on earnings is visualized from that charge."

Capacity is not expected to increase greatly in 1964, the report said, despite deliveries of Boeing 727 jet transports. During a general economic decline, the committee forecasts continued benefit from the factors that for 1963-70 improved investment.

ATA staff in conjunction with the Henry Goldfarb Co. of New York, a firm of transportation consultants. Essentially, the plan called for the elimination of ATA's advertising and a strengthening of the ATA's management so that contract advertising could be handled by ATA itself personnel, rather than by

representatives and officials of the airlines, as in the past. General feeling among the directors appeared to be that, while the Air Traffic Conference may have its weaknesses, it should be recognized rather than killed.

The committee planned to evaluate the Goldfarb plan in its executive how on director proposals can be taken up through the ATA.

Directors also voted to establish the Office of Enforcement as permanent department of the association.

ATA Reorganization, Advertising Plans Deferred; Budget Cut 7%

Washington-Air Transport Assn. Board of Directors last week deferred immediate action on a proposed sweeping reorganization of the association and a planned \$5 million sales and advertising campaign.

At the same time, the Board of Directors also cut ATA's 1965 budget to \$2,140,000, a 7% reduction from the 1964 figure.

Both advertising and reorganization plans were referred to committees for further study, minus that an interim report is necessary to the board of directors.

The advertising campaign is to be staged by a top-level management committee appointed by ATA's president Stuart G. Tipton. The committee will be instructed to narrow the scope, content and objectives of the campaign.

Cost-effective findings are to be submitted to the Board of its next meeting in March.

The plan for the campaign emerged last June at the mid-year directors meeting, when the ATA was directed to prepare a presentation for consideration by the Board. The Sullivan, Schuler, Caldwell and Butler advertising agency prepared the presentation.

Tipton was instructed to name a sub-committee to study the program plan, which was developed by the



Ethiopian 720Bs to Begin Service Next Month

Ethiopian Air Lines will inaugurate service with two Boeing 720B jet transports Jan. 15, using the aircraft on all of its routes through sub-Saharan Africa and into South Africa. First 720B shown above on a mission over Bonga, Ethiopia, and its sister ship seen above in the new airport at Addis Ababa only this month. Aircraft is powered by two PW6A JT3D-1 turbojet engines.

SSR Acceleration Urged

Washington-Airline Club Eagle II (CII) last week urged the Federal Aviation Agency to accelerate the supersonic transport project to that the U.S. can retain its superiority as a commercial airline.

In a letter to Federal Aviation Administrator N. E. Hahn, Eagle II called on the agency to determine whether the U.S. can do a supersonic transport by 1967 and have it in commercial service by the end of the decade, the same time as the British and French for their joint Mach 2 supersonic project (AW Dec. 8 p. 41).

Eagle said that if the U.S. does not meet the British-French challenge, it will lose its world leadership in commercial aviation, along with 90,000 jobs a year by 1970.

Eagle said "... in the view of some agency that we should go into the Mach 5 program, or use the technology we now have in the Mach 2 program and use it to make them step by step?" First recommendation for a supersonic transport project by the U.S. can be submitted to President Kennedy by Hahn by Jan. 3.

Pan Am-TWA Merger Plan Expected Soon

Washington-Proposed Pan American World Airways merger with Trans World Airlines was the subject of much speculation late last week. Chances appear strong that a joint announcement confirming a full merger agreement by the two carriers will be made next week.

Meanwhile, Federal Aviation Authority recently announced a Civil Aeronautics Board examiner's ruling that the two carriers will not be required to submit internal studies prior to the merger plan in the Transatlantic Route Review Case. In taking issue with the ruling by Executive James Keith, Scotland said:

"There is no great in determining at this time the questions of whether Pan American and TWA should avoid post-merger, in favor of one, competition, or whether TWA's second aircraft would serve should be determined after one of these carriers may within a short time no longer exist."

Scotland proposed a deferral of proceedings in the case until the issue is decided.

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Beech Negotiates DH-125 Distributorship

Negotiations are under way between Beech Aircraft Corp. and de Havilland Aircraft Co. of England for distributorship rights in the DH-125 executive turboprop aircraft. Talks began about two years ago, but apparently have been renewed with increased intensity during the past few months.

Frank E. Herbick, Beech executive vice president, told Aviation Week that under one possible program de Havilland would give the use of Beech's entire manufacturing sales organization for the DH-125.

Beech would handle G 3 sales.

Coupled with these negotiations is Beech's delay in meeting a firm demand to go ahead with production of its eight-passenger, twin turboprop Model 120. A meeting of the executive committee of the company is scheduled for January to decide on the future of the turboprop aircraft.

Original plans called for the aircraft to fly in 1964 and its first delivery in 1965, but Beech has been reported to be slightly ahead of schedule on the project (AW Oct. 1, p. 15).

Herbick indicated that any agreement to market the DH-125 in the U.S. would not necessarily mean discontinuance of the Model 120. It is not possible that both aircraft might be able to live together in the same environment.

DH-125 currently is flying in England and is in production at de Havilland factories at Hatfield and Chertsey, England. Royal Air Force has ordered 25 and two have been purchased by private firms (AW Dec. 1, p. 118).

Beech is one of several American companies which have been talking with de Havilland regarding possible U.S. distributorship rights. Included among these companies is Pan American World Airways.

However, de Havilland probably is in need of an extensive worldwide marketing organization which a large American manufacturer, such as Beech, would be in a position to provide.

Beech, on the other hand, is no doubt looking for an impulse to compete with American-built turboprop executive aircraft, such as the Lear Jet and Jet Commander 5121.

Discussions between Beech and de Havilland also are reported to have touched on the possibility of de Havilland buying the DH-125 advance and sending it to the United States where Beech would sell the wings and engines, but this is at present regarded as a doubtful possibility.

Modified Swissair 990 Shows Speed Increase

Zurich-Instal flight tests of an operational Swissair Caravelle 990 medium-range jet transport modified by a low drag configuration indicate that the aircraft gains an additional 30 mph in maximum cruise speed plus a reduction in specific fuel consumption.

First aircraft to be modified here at Smease headquarters under Caravelle direction was returned by regular service early last week after a season of performance test flights over the previous work-end. The three basic aerodynamic changes were designed to bring the aircraft to within the German-mandated performance parameters, and Swissair officials say that the tests tend to confirm that the modifications were satisfactory (AW Oct. 26, p. 74).

Airframe Changes

Changes in the airframe, the first operational 990 to be modified for this purpose, included:

- Substitution of Krueger leading edge flaps for the leading-delayed aircraft
- Aerodynamic streamlining of two engine nacelles by use of a nose cone, that change into a closed position after

the final movement during flight. Cost, which spent about seven months in use adds approximately three fuel to the way of length at the nacelle.

• Cutting drag along the trailing edge by placing a fin in the external wing attachment to the landing section.

Modification Costs

Contract, which will absorb the cost of modifying all five 990s operated by Swissair plus two others which the airline has leased to Scandinavian Airlines System, supplied this bit for the modification plus a supporting expense item in Swiss flight plan. Actual work, however, was carried out by Swissair mechanics.

Tests showed that the true maximum cruise speed of the aircraft was increased from a previous 550 mph to about 620 mph at altitudes of 20,000 and 39,800 ft. At one point, with a tail wind of about 65 mph, the modified 990 reached a calculated ground speed of 645 mph. Federal Aviation Agency has authorized the 990 for a maximum cruise true air speed of 625 mph.

Airline officials say fuel consumption after a marked decline at Mach numbers of 0.90, 0.94 and 0.98. Two figures on the ground of a decrease, they said, cannot be established until after

further operational tests have been completed.

Swissair aircraft approximately two months to complete the modifications on the first aircraft. Second aircraft is scheduled to enter the dock early this week and, as work progresses, Swissair officials say the time required to complete the modifications on an individual aircraft should be substantially reduced.

Cuban Route Boosts CSA Passenger Totals

Fugate-CSA Caribbeaircraft. Airlines estimates it will carry more than one million passengers a year over 1961 at about 150,000—about a total of approximately 47,000, 100 less than the entire structure during 1962.

A major factor behind the boost, according to the airline, was its Brazil-Batavia service, an increase which began early this year.

International services to 34 cities in Europe, the Near and Far East, Asia, Africa and Cuba will account for 75,000,000 ton mi. Domestic services between 11 points throughout the country account for 17,150,000 ton mi., and air taxi operations for the remaining 157,100 ton mi. of the total figure, according to CSA.

The airline's total route mileage is 62,100 statute mi.

In 1961, CSA handled 858,355 passengers and flew 15,441,610 ton mi. Most profitable market, according to a Czech Foreign Ministry of Transport official, are Caribbeaircraft, Prague-Throm, Prague-Dubai and Prague-Vietnam Airlines services.

London Airport Fog

London-Fog cut visibility to 10 yards at London (Heathrow) Airport and completely halted airline traffic there last week. In a four-day period, the only airlines to land at Heathrow was a Ministry of Aviation Vickers Viscount flight for submarine landing (AW Nov. 5, p. 47).

International flights departed North Atlantic routes to Frankfurt, as was the case of British Overseas Airways Corp. Tours World Airlines planes overflew London for Frankfurt. South European Airways Corp. cancelled 30 flights in a single day, spending a few hours of London (Gatwick) airport during one period of closing fog.

Viscount landed in near sea visibility after a flight from Heath Lowland. It was the first time at Heathrow. Air traffic is supported with British Airways. British aircraft and authorities. Directional guidance was provided by Heathrow's ground ILS system.



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Eastern Pilot Tried Go-Around Prior to DC-7B Crash at Idlewild

By James R. Ashlock

New York — Federal investigators probing the Nov. 30 crash of an Eastern Air Lines DC-7B at New York's Idlewild Airport have the clipped tips of two aircraft trails to indicate the plane's descent rate and path prior to ground contact.

South through the north indicates the aircraft was not descending at a rapid angle, but was reaching downward at approximately 3.5 deg. The plane was also following a course several degrees left of the runway's 40 deg. bearing.

Evenly spaced slashes in the red show that the abandoned propeller struck the ground first. The engines and fuselage all hit the landing area but a foot, ripping open the left wing and fuel cells. Fire ignited dry vegetation at this point.

Each slash is in front of the first impact point, where investigators believe the plane bounced back into the air before hitting a second fuel tank just short of a runway. Bounced strikes in the terrain present are on the far left from which point the plane dodged approximately another 100 yd.

The left wing halted to the right and behind the tail section. The right wing, also severed, landed upside down to the left and forward of the cockpit, assuming the belief that the airplane engaged severely before coming to a stop.

Although the outer skin of the vertical stabilizer was mostly burned away, the tail section aft of the rear fuselage remained unscathed. The one saved protrusion, all of the fuselage, but not better 25 of the 50 persons aboard had escaped.

Capt. Edward Bookbaldt, 41, a 16,000-hr pilot and commander of the Airline Pilot's Association of 35 airports, died with the two other cockpit crewmen. The flight's two business travelers.

Ground fog, which cleared in seconds, some the report, was present at the time of the crash. Approach was being made to Runway 4R. The plane never contacted the tower, but would not agree to the left and reached 4,300 ft down and 300 ft to the left of the strip. Gear was retracted, leading investigators to speculate that Bookbaldt had anticipated a go-around after a missed approach.

Communication with the pilot ended before the accident, which occurred at 9:45 p.m., indicates that at one time he did have radio contact with the tower, lights, most likely just before he descended into the shallow ground fog, investigators said.

Bookbaldt reported that the tower did not have a high intensity border beacon which marks the runway approach path. The lights cannot be dimmed, but were turned off to comply with the pilot's request.

Flight was No. 512, arriving non-stop from Charlotte, N.C. Field conditions as reported to Bookbaldt by tower personnel were one mile visibility with ground fog.

The fog was described afterwards as having just moved in, shifting with down moving patterns. The threshold of Runway 4R is near the shore of Jamaica Bay, where investigators say the heaviest patches might be expected under conditions existing at the time.

An Eastern Electric loaded weekend accident was minutes ahead of the ill-fated plane. The CAB will duplicate the situation in tests using an Electra and a DC-3 to determine whether the strong E-turbines, passing near the turbine inlet Landing System transmitter shore, may have affected the ILS beam.

Permanently Approach Radar has been inoperative at Idlewild since Nov. 15, equipment for the unit being relocated in the Idlewild tower. Notices to airmen (Notams) were issued, and tower personnel also advised inbound flights of PAW unavailability.

A runway transponder, used twice which requires visibility at the runway threshold was also inoperative. The ILS middle marker had also been out of commission, but, investigation is a sign of a runway, 4-40 p.m., 4-4 minutes ahead of Flight 512's arrival.

ILS Approach

Investigators emphasize that none of these actions being out should affect a pilot's making a normal ILS approach. Evidence that Bookbaldt had a radio contact also needs to document full use of landing aids as a determining factor in the crash.

Down fog transposed the doors of the lighting and emergency vehicles in getting to the crash scene. The fire was so intense that the team supply of the fire trucks was quickly exhausted and water was brought in from police cars from a half strong firemen at the field.

Arthur E. Nussbaum, CAB investigator from Denver, came to New York to direct the crash probe. He said a full investigation with the full spectrum of possible accident causes will be conducted. Official hearings on the accident aren't expected until sometime after the first of the year. The hearings will be conducted at New York, New York and.



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Gulfstream jet's large cargo door has received FAA certification. Aircraft seats a maximum of 24 persons.

FAA Certificates 24-Passenger Gulfstream

Gulfstream jet's large cargo door has been certified by Federal Aviation Agency as 65 ft. long, 10 ft. wide, and a convertible cabin capable of carrying up to 24 passengers or a cargo-passenger mix. Maximum one-half weight of the aircraft was increased from 26,170 lb. to 29,714 lb. without structural modifications. Convertible cabin has a five-track system making its entire length. Gulfstream can carry 24 passengers, baggage and provisions across approximately 1,400 sq. ft. or one cargo in excess of 8,000 lb. of cargo 650 cubic ft. Stowage capability with standard loads is 2,600 sq. ft. or the convertible one cargo in excess of 1,200 sq. ft. of cargo with eight 100 cu. ft. segments with seat stowage.



Seats in the 24-passenger Gulfstream have 15 in. pitch and are separated by a 16 in. aisle. The five-track track system in the floor allows the seats to be removed from the aircraft cabin and cargo hold as to be substituted equally.



Cargo-passenger mix is shown above left with wings at 100 ft. Right, Rolls-Royce Dart engine is tested aboard aircraft which still has 12 seats in place at 1,200 cu. ft. cabin. Seats can be stored aboard aircraft after removal from cabin.



PROGRESS



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The BAC One-Eleven will come off the production line in 1963. It has already been ordered by BRITISH UNITED AIRWAYS, BRANIFF INTERNATIONAL AIRWAYS, MOHAWK AIRLINES, KUWAIT AIRWAYS, CENTRAL AFRICAN AIRWAYS and an undisclosed airline. Passenger appeal and low break-even factors make the BAC One-Eleven the first choice for all short haul operators.

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AIRLINE OBSERVER

✈ British Overseas Airways Corp last week served notice on the British and French governments that while the airline is registered in the great March 27 deadline, it will not be flying to London until August 1, because of the expense of the BOMC. BOAC said it requires the return of the aircraft, and in view of current contingencies, primarily for the Vietnam-Vietnam, it cannot afford to wait not doing so quickly. BOAC said it will raise no compensation for a temporary transport until flight rights enable the carrier to raise the plane's suitability for service to provide the level of input to enhance period used until the aircraft is proven adaptable to air traffic control facilities existing at the time of its introduction.

■ Chief obstacle in the continuing drive by Aeroflot, the Soviet airline, to gain access to the Western Hemisphere is Gromov's recent refusal to grant Aeroflot beyond rights across the North Atlantic from Conakry, a key point in the Russian carrier's plan to operate a route from Moscow to Belgrade, through Africa and beyond to South America (AW Sept. 18, p. 71). Conakry airport, built with Soviet aid, is the only airport available in Russian-occupied Africa with runways long enough to accommodate long-range aircraft. Aeroflot has discussed an air route between Brazil and Russia with Panair do Brasil (AW Nov. 26, p. 41).

► Common stocks of Delta Air Lines, Northwest Airlines and Western Air Lines listed on the New York Stock Exchange have been particularly strong recently. Through the middle of last week, all three stocks repeatedly recorded new highs.

• Air Lingus is closely studying the Gatteville, Boeing 737 and BAC 111 for use in its continental European routes. The airline would prefer to continue use of its fleet of Vickers Viscounts 500 transports on these routes as the "most economical" aircraft for this operation. However, Air Lingus feels it must offer air services for competitive reasons.

* **Vehicle Traffic Engineering**, a division of British United Airways, is exploring possibilities of a super Caravelle car ferry transport, using Douglas DC-6 and DC-7 aircraft, as a follow-on to the company's present DC-6 conversion — the ATL 99 Caravelle (ENR/Sept. 4, p. 46). The firm now has 14 Caravels and plans an extensive sales program in Hawaii this month.

* Development of a program establishing basic rules for the full exchange of traffic rights in international air transportation is the only item on the agenda of the meeting of the Commission on Air Transport of the International Chamber of Commerce, beginning Jan. 11 in Paris (AW Nov. 26, p. 39).

■ Aeroflot's two-turboprop Antonov An-24s will have a lower "several million ton-kilometers" with mail and cargo by the end of 1992. But after nearly thirty years of testing, the radium-orange transports are still not in regular passenger service. An-24s engaged in cargo and mail-Gorkhomskaya flights are based at Krasnodar and Brjansk, Kherson and Nikolayev on the Black Sea, to Simferopol in the Crimea, and to Moscow, Leningrad, Dnepropetrovsk, Donetsk, Lvov and Minsk.

► Japan Air Lines last week ordered three Convair 440-M turboprop transports, bringing the carrier's fleet of this model to eight. Delivery will be made in March and April, 1963, and the planes will be used exclusively on the airline's domestic routes.

▶ Latest series of highly-publicized aircraft accidents is expected to have a depressing effect on year-end traffic and revenue results. Most carriers had anticipated a profitable Christmas traffic season to round out a relatively successful year, but now feel that December results will drop well behind those recorded in the same month last year.

► San Francisco and Oakland Heliporter Airlines will inaugurate direct service between San Francisco International Airport and Oakland Downtown Airport and between San Francisco International Airport and Berkeley Heliport on Dec. 17.

SHORTLINES

► **Allghway Airlines** served 92,231 passengers in October; the best one-month passenger mark in carrier's 13-year history.

■ **Capital Airways**, Nashville-based cargo carrier, has placed its five 707s with the Greater Airmail Corporation to carry cargo transport in commercial service. Aircraft would be used only for military shipments under USAF Letter contracts.

• Delta Air Lines showed an increase of 21% in passenger revenue index during the month of November compared with the same month last year. Load factor increased from 96.52% to 96.97% in the same month.

► **Pittsburgh Airlines** last week accepted delivery of its two Boeing 738 turboprop transports and flew the two aircraft from New York International Airport to Adak Alaska. The jets will go into service Jan. 17.

• Federal Aviation Agency is using a new fire chamber designed by the University of California to study airport runway lighting under low visibility conditions. The chamber generates fog through a mixture of compressed air and water. Experimental airport lighting patterns are laid out on the asphalt floor on a 10-ft scale.

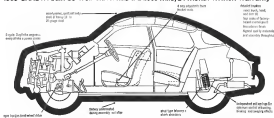
■ **China Airways** soon will begin scheduled air service from Accra to Aden via Beirut, Khartoum and Amman. The new service will help strengthen air communications between west and east Africa. Visit regularly to secure in Africa is more north south.

► **Korean Air Lines** has purchased two Fokker F-27 Friendship turboprop transports for domestic service and for its route to Hong Kong via Okinawa and Formosa. The airline bought F-27 sales to 211, purchased by 72 customers.

► Six-month test period during which U.S. export targets will be cleared in reports of origin rather than at international gateway airports began last week. The experiment is being conducted by Commerce Dept., Bureau of Customs and Census Bureau to determine whether the new method will increase and expedite shipments.

► United Air Lines is seeking a coach fare for a twice-daily Sky-Bus service between Cleveland, Pittsburgh and Miami in Douglas DC-6 aircraft. Fares would range 15 to 20% below current jet coach rates.

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STANDARD ARMY UH-1B shows traditional cluttered appearance of most present-day rotary wing aircraft. Note drag-inducing intake duct, unshrouded engine cowling, and aft rotor cowling creates sharp air flow lines.

Tests Show 250-mph. Helicopters Feasible

By Evans J. Hoffman

It. Worth, Tex.—High-speed capabilities of helicopters are being demonstrated here in flight tests with a modified Bell UH-1B helicopter which has been used to confirm that 200-mph rotary wing aircraft are feasible now.

Speeds of 225-240 mph should be possible in the near future utilizing existing state-of-the-art technology, Bell engineers feel.

Tests by Bell Helicopter Co. pilots under a program sponsored by the U. S. Army Transportation Research Command (TRDCOM) to evaluate the effects of reduced drag reduction schemes are expected to clarify and strengthen the position of helicopters in the high speed regime. Helicopter performance in this area has been checked in recent years by extensive computer air tests using VTOL systems aimed at overcoming what appeared to be inherent speed handicaps in the basic rotary-wing configuration.

Each version of the research UH-1B twelve-blade helicopter thus far has been flown at level flight speeds of more than 175 mph, exceeding by some 40 mph its standard tactical speed and has been the fastest helicopter speed record for its class by about 20 mph. (AW Nov. 10, p. 38) Additional modifications planned in the program are ex-

pected to curble the same handicap, to climb up to 270 mph, next year.

Indications are that lessons learned in the current program will be useful across the board to all classes of helicopter, civil and military. TRDCOM Design & Performance Division Chief Paul Carpenter expects that the research Bell UH-1B demonstration will significantly influence Army thinking on performance requirements for its future helicopters.

Speed Requirements

As he told Aviation Week, "The research has automatically raised the maximum speed requirement in any future helicopter competition by 25-30 kts."

Carpenter added, that there has been enough speed in a year ago, he would have settled for approximately 175 kts speed in developing a research helicopter high performance program, but on the basis of what he has seen demonstrated thus far with the UH-1B, he would not settle for less than 225 kts performance should he now be buying new specifications for such a vehicle.

As pointed out in Aviation Week (May 12, p. 247), a basic problem has been higher speed performance of rotary wing aircraft has been high-speed configurations that could never have been tolerated in forward attack.

Need was evident in clean up design details to bring the machine's aerodynamic characteristics up to par with the advances made in rotary wing aircraft powerplants.

Much of the slow pace in facing up to this problem could be attributed to the customer's desire primarily for safety, rather than speed, resulting in less radical configurations, and little regard for the position paid by cluttered rotor systems. On the military side, more factors were possibly concerned with meeting government and military obligations since speed seemed to be a secondary consideration.

A clean up project could be made of the basic UH-1 configuration. Although it, in one instance, represented a major advance by providing the Army with the advantages of a helio, powerplant, part of the high performance that results could have been gained in a result of increased power and lower engine weight, was automatically negated by the customer's desire in the case to reduce later loading to one minute per patient, if possible.

This consideration prompted Bell engineers to consider a broad fuselage configuration, permitting straight-in lift-off loading, but deterring a basic width sufficient to take the length of the legs, resulting in a high-speed fuselage configuration.



MODIFIED BELL UH-1B shows effects of aerodynamic cleanup. Helicopters still had cluttered area where photo was taken, but having very good view of it, along with engine. Aerial support having was added to new color and extensive minor changes were made.

Such considerations are comparable with a utility helicopter, but require an increased performance level that is not likely to be the same machine be adapted for attack roles.

Tacticians had to determine if speed in lift-off loading was more important than a clean, narrow fuselage, whose lower drag would provide increased range with the same power, in weighing these requirements.

Indications are that more considerations will be given towards developing specific configurations for various duties to take advantage of design technology that can provide maximum performance within this attempt to develop an all-around helicopter expected in health, leisure or cargo one day and deliver demanding horsepower at high ranges the next with much hope of high new record times.

Helicopter Research

Considerable research has been done over the years by military and government agencies on various methods of measuring helicopter performance, but due to lack of funds being available to prove that theory in actual flight, little progress has been made towards taking advantage of this research.

National Aeronautics and Space Administration researchers at Langley Laboratories have been trying for years to get development started on a research helicopter that would be the counterpart of the X-series of research airplanes, but this program regularly kept being deleted from the agency's

budget. In the spring of 1969, TRDCOM, with a limited budget entered negotiations for funds from private industry to do studies on feasibility of increasing helicopter speed, range and cargo capacity efficiencies based on critical state-of-the-art technology.

Several and Vortel were selected from 15 proposals to do funded three month studies and Bell Helicopter Co., requested permission to participate

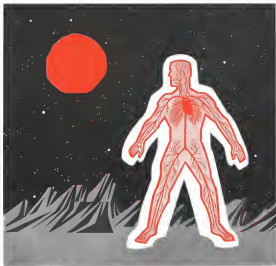
in the program as a company-sponsored team.

Preliminary design studies submitted by the contractors all showed that a 275-kts helicopter was reasonably within grasp using good aerodynamic design practices.

The three contractors basically came up with the same conclusions, that fuselage drag could be reduced some 50%, alterations might be the most



THREE-BLADE ROTOR hub mounted on research UH-1B. Tailor shape the rotor mast is a key design device to measure losses and chord bending moments of the hub and blades.



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The first integrated space-suit assemblies will be developed by Hamilton Standard for Project Apollo, under contract to NASA. They will provide comfort and mobility for astronauts outside the craft in deep space and on lunar exploratory missions. Hamilton Standard, as prime contractor, will manage the program, and design and build life support packs. The packs must supply oxygen and pressurization and control temperature, humidity and contaminants. Subcontractor for the suits will be International Latex Corporation.

The space-suit project, an important portion of Hamilton Standard's life support program, applies diversified experience in hydraulics, pneumatics, mechanics, electronics, and packaging. Hamilton Standard blends and develops these basic technologies to achieve an integrated systems approach to life support equipment.

Hamilton Standard DIVISION OF UNITED AIRCRAFT CORPORATION
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which, problems at high speeds but this could be solved and that there would be adequate mobility at high speeds but actual flight tests would be the only way to prove these studies.

Results of these studies which also indicated that fuel consumption could be reduced some 25% at cruise speeds because of lower drag, generated considerable enthusiasm in the office of Army chief of transportation Maj. Gen. Frank Besson, due to the obvious value in reducing fuel logistics problems.

UH-1B Modifications

Bell test cell was given funds by TRICOM to start a research program, utilizing a modified UH-1B, to evaluate the effects of drag reduction. One of the initial steps in the modification program, was to reengineer a variable tilt rotor system, to permit rotor turning a fixed, low drag forward attitude in lightened helicopter flight. The reduction of drag on the helicopter also cuts down loading on the rotor. Bell engineers point out that the standard UH-1B configuration imposes approximately 1,200 lb more loading on the rotor at 120 kt than must be carried during engine rotation.

Bell engineers have provided a rotor mast tilt capability from 4-deg forward tilt through 11 deg. The entire rotor transmission is mounted on a track having an arc of rotation adjusting the angle of couplings between engine and transmission, splitting the degree of misalignment of couplings during rotation in a figure eight within the capabilities of the couplings. Grease, mounted onto the facility on pivots, is rotated by means of two electric motors in hydraulic situations through an infinite range within the 4- to 11 deg tilt capability of the pilot.

Fixed Tilt

The variable tilt mast feature is strictly a research tool; selection is that a fixed tilt of perhaps seven degrees will be reasonable amount to provide desired performance. Should further testing show a definite requirement for greater tilt an 18- to 15-deg, perhaps a two-position rotor tilt provision would be added.

Roll rotor pilot also has been given with modified additional chord being provided and profile contoured to approximately five degree angle of attack, reducing the roll rotor approximately 50% at high speeds and providing an additional 10% power to the main rotor system.

Most noticeable external changes to the research UH-1B probably are the extensive fairing and reduction of protrusions. A glass fiber honeycomb arched shaped fairing approximately 160 in long has been added on each side of the aft rotor to reduce the effects

of the normal fairings suddenly narrowing at this point into the tail boom. A large streamlined glass fiber pylon craft surrounds the rotor mast and covers the normal protruding engine intakes.

Fairing large, reduces drag and turbulent effects of protruding mast hardware, including engine pylon. Normal intakes are replaced by smaller, fixed intakes on either side of forward pylon fairing, leading air to the pressure chamber in glass fiber ducts. Induction air that these intakes provide more positive pressure rate than standard intakes stress the engine compressor face, improving engine efficiency. Two small spring loaded panels, hinged up on the sides of the pylon fairing, open up to provide air to chamber and prevent blade up

reflection through the forward facing window.

Bell is doing considerable study on reducing the main rotor control system, modifying the main rotor to enable control tube linkage to enter pylon area to be brought in closer to the mast and thus permitting a reduction in weight of the pylon fairing. It is believed that eventually this weight could be reduced from approximately two feet to only five inches. Also to be fixed are glass fiber fairings covering the main rotor blade gaps.

Another noticeable change in the main blade main rotor configuration has been deletion of the Bell stabilizer bar, which is used to account for in loads at 50% of the total drag at 150



CLEANER-UP FRONTAL AREA of the modified research Bell UH-1B, top, is evident in comparison with standard model, below. Airframe and main rotor section air flow have been removed and landing skids considerably reduced in size.



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LATER VERSION of the research UH-1B has a three-bladed rotor and will be used to test the effects of the helicopter's speed range. Rotor configuration will include one up and one down type. Note lower engine intake on lower portion of the forward pylon housing.

to. Stability has not been compromised to a considerable extent, albeit rotor, but at higher speeds than now flown, an alternate stabilization aid probably would be necessary.

Skid landing gear has also been successfully cleaned up, and level recovery carrying the first step has been deleted and landing gear has been added to all observations. Fuselage lines have been further cleaned up by removing the former air ducting from the doors to define protruding tracks and mounting down with streamer para-type lamps. Antennae and mirror view sensor mounted under the nose also have been deleted.

Main Rotor Loads

Classroom program has resulted in the research UH-1B having a flat plate drag area equivalent to approximately 11 sq ft compared with some three double that for the standard production configuration. In place of one rotor loads are down some 40%. Vibration levels have been greatly lowered—plots report that they are flying approximately 20 mph faster before they reach equivalent vibration levels as the standard UH-1B.

Research helicopter can now stand and UH-1B's speeds at approximately 25% lower power levels, range at some power levels a short 70% greater. Modifications continue on the research machine which will not be testing three blade rotor and rapid rotor configurations, designed to permit speeds up to 180 kt. Configuration will permit blade pitch control to be locked out to provide full rpm capability.

Next spring, stub wings of 26.7 ft span will be added to the research UH-1B. Wings will have ground adjustable sweep from 13.5 deg. to 27 deg. and in-flight adjustable incidence up to 20 deg. Plans have been made to add military Continental J69-T9 turboprop engines as pods on either side of the

hatch; next August. This will allow studies of all variations in flat plate drag and these effects at a high speed rotation must range up through 200 ft. These studies may be useful in determining the value of modifying current conventional helicopters to provide higher performance for special missions.

PRODUCTION BRIEFING

Space Nuclear Propulsion Office has requested bids for support services at the Nuclear Reactor Development Station at Jackson Hole, New Mexico will include physical engineering, bookkeeping and technical services associated with handling and operating facilities using cryogenics. Bids are due Jan. 30 at the Las Vegas SNPO.

Bid requests will be issued soon after Jan. 1 for construction of a cyclotron for Langley Research Center's space radiation effects laboratory, to be built at Chester Point near the center. Facility will cost about \$12.4 million and will go into operation in mid-1967.

Rockwell Instruments, Inc.'s Systems Division will build 75 electronic test units which will be used to monitor and help calibrate flight instrumentation and instrument control systems on the NATO version of Lockheed's F-104 jet fighter. Work is funded under a \$175,000 contract from North American Aviation, Inc.'s Aerospace Division, a subsidiary of the instrument control system.

International Telephone & Telegraph Corp.'s Wiring Communications Systems Division will install an inter-city communication system at the Whitehouse AT&T, Mass. Mainframe ICEN site under a 36-month Air Force contract.

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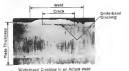
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Never use electrodes or wire flux combinations containing vanadium to weld "T-1" Steels. Vanadium is known to be stress reliever. Weld metal containing vanadium is likely to be made brittle by stress relief. Stress relief is only necessary with "T-1" Steels when re-

quired by codes and one or two other special cases.)

When welding "T-1" Steels to a lower strength steel, use low-hydrogen rods of the strength level recommended for the lower strength steel.

Proper handling of electrodes is also important. When exposed to air, low-hydrogen coatings will soak up moisture which is a rich source of hydrogen. Keep your electrodes dry. Make it a practice never to open more than 30 minutes' supply of rods at a time. A dry way to keep rods dry is to keep them in a 250 °F oven. If your rods have absorbed moisture, bake them in an oven according to the manufacturer's recommendation. One hour at 100°F is average.

To sum up Rule 1, for manual welding use low-hydrogen electrodes and keep them dry. For submerged arc or inert gas shielding arc welding, use thoroughly dry fluxes and wear true shielding gases.

RULE 2—Use correct welding heat

On most levels of structural steels, high heat input results in superior welds. With "T-1" Steels, just the opposite is true. The best welds in "T-1" Steels depend on never getting over a certain maximum amount of heat. Less heat is used as the weld will cool quickly which, in "T-1" Steels, results in good, tough welds. Thus, you must closely control the amount of heat put into the weld.

For this reason, never preheat "T-1" Steels except in special cases. Preheating means more heat to get of and a longer cooling-off period, which can be harmful to welds on "T-1" Steels. The cases in which preheating is necessary are those in which the steel must be tempered to get rid of excessive stresses (hydrogen soaked), where the piece is so restrained it doesn't have room to shrink after welding, or when thick plates over 1" are being welded. And in the case, however, preheating isn't necessary, and never preheat "T-1" Steels as much as usual.

The heat you put into a weld depends principally on amperage and the speed at which the arc travels along the joint. The higher the amperage, the more heat input. The slower the speed, the higher the heat input. Controlling heat input requires keeping amperage below certain ratings and keeping the speed of arc travel above certain speeds.

There are two other important items to keep track of: steel thickness and temperature. Thicker sections can safely soak up more heat than thinner ones, so you can use more amperage and slower speeds. As for temperature, the section may have been heated up by preheating or by previous passes of the electrode. So if the section is already hot, you must cut down on amperage or increase speed to avoid excessive heat input.

Heat Input Calculator.

There's an easy way to determine the safe heat input for USS "T-1" Steels: the circular Heat Input Calculator which is provided with this booklet in the coupon. With it you can quickly find out what amount of heat will result from any given setup, and determine how much more you can safely put in. It is a



circular "slide rule" which tells, on the front side, how much heat will be put into the joint if you know the amperage, voltage, and arc speed. On the back side of the calculator are tables showing the safe heat inputs for "T-1" Steels in several different thicknesses at different temperatures. This handy device is designed to help you get good welds every time. Heat inputs may also be calculated from this formula:

$$\text{Heat Input per inch} = \frac{\text{Amperage} \times \text{A.C. Volts} \times 100}{\text{Speed, inches per min.}} \quad \text{Weld Speeds (inches)} \\ \text{Per inch of weld}$$

RULE 3—Use recommended welding procedure

The straightforward or stronger bend method is preferred for welding "T-1" Steels. Do not use the "Add on" method. Waving beads the metal more because the arc travel speed is slower and may cause excessive heat input. The proper method is to fill the groove with a succession of stringer beads. Before a bead can be laid over an earlier bead, the flux, scale, or oxidation must be removed.

Back gouging, the preferred method is easier gouging followed by clean-up grinding. Do not use an oxy-acetylene torch. There is danger of overheating which may cause an undesirable joint.

Speed. Whether you can weld at the machine or hand, control it closely. The Heat Input Calculator described above is your guide to the proper speed to avoid excessive heat input.

Fillet welding. Good fillet welding technique is more important with "T-1" Steels because the joints are usually required to withstand greater forces. Fillet welds in "T-1" Steels should be smooth, correctly can be used and well fused in to the legs at the points to be joined. The layers of each weld should be made so that there is good root penetration but no under cutting. The weld shown on the left is ideal, the one on the right is to be avoided.



When thick grooves are joined, and when the weld metal is to be stress relieved, fillet welds can be troublesome because of toe cracking. There are several

ways to eliminate toe cracking near fillet welds on "T-1" Steels. In the case of Tee or E-joints where lower strength welds are often the rule, use low-hydrogen rods of the E6015, E6016 and E70-class. They have lower strength and more ductility, they are less likely to "spall cracks" at the toe of the fillet weld.

An hammer grinding of the weld can also be very helpful in preventing cracks, especially if the weld is to be stress relieved. Items made even with the higher strength rods of E6015, E6101 and up) should be free from toe cracks if ground. Sometimes it is necessary topeen each pass, at other times, peening only the toe areas will prevent cracking. After peening, the fillets should be smoothly ground to fair the fillet into the legs of the joint.

Other methods that can prevent cracking include use of a soft wire pedestal, machine grinding the base of the upright piece, and laying down "butter" welds in toe areas. The first two methods allow the upright leg to "shrink down." The "butter" weld strengthens the "T-1" Steel in the area where a toe crack may start. It is ground off prior to actual fillet welding and must be located so that the toe areas of the fillet will be laid right over the strengthened zone.

Free Welding Help.

The above information is spelled out in greater detail in our free booklet "How to Weld USS "T-1" and "T-1" type A Steels." It is included in the book is a Heat Input Calculator that helps the welder choose the proper welding machine settings. We'll gladly furnish enough free copies for your shop personnel also, you'll find out just how easy it is to make color metal picture or the same name is for help in demonstrating to your welders the proper techniques for welding USS "T-1" Steels. Send the coupon. USS and "T-1" are registered trademarks. United States Steel Corporation • Columbia Gateway Steel Division • McDaniel-Tulley Division • Tennessee Coal and Iron Division • United States Steel Supply Division • United States Steel Export Company



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This movie will give you a practical
in-depth view of welding, weldable steel



The real low-down

When ground troops call for close air support (in all-weather) Republic's F-100D can deliver. Not new support in body slaps, but *very* close. Sifts enemy radar just over the lines. F-100D is built that way itself to slip away safely, to strike again another day. Built to do it in any weather, any time.

For point accuracy, all-weather capability and terrain avoidance are automatic with the F-100D. Equally automatic and fully integrated are its fire, flight and navigation controls.

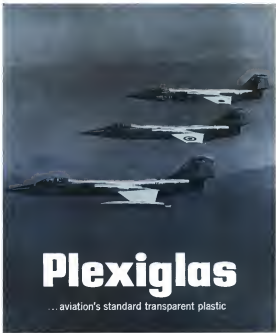
Its punch is versatile: everything from nuclear to conventional bombs; from 50 mi. cannon to a wide variety of missiles. Operational speeds range from 300 mph to almost Mach 2. F-100D is a fighter and a bomber. One man does it.

F-100D exists. It is flying in Europe and the Pacific with the U. S. Air Force.



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Plexiglas canopy on the Lockheed F-104 Super Scoop fighter is made of Plexiglas® to resist stress. The F-100 and many other fighter aircraft have Plexiglas canopies for structural use in United States, Germany, Belgium, The Netherlands, Canada, Italy and Japan.

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we progressed so that they deflect only 15 deg. when the flaps are down, and 30 deg. when the flaps are up. Both these deflections should produce a roll rate of one radian per second. Elastic spoilers deflect to 45 deg.

Roller-rod curves with balance tabs. If one roller-rod system should fail and produce a hard-over signal, the other roller-rod would deflect automatically to compensate. There are dual tone dampers for each roller-rod with authority confined to five degrees on top of air-spring pedestal signal.

Hydraulic Systems

There are three hydraulic systems. Two of these are dual parallel systems for longitudinal and lateral control, and the third is a backup system for the rudder. First of the systems is powered by dual pumps driven by the left and center engines. It operates the ailerons, control and flap systems and the landing gear. Second of the systems, which operates automatically with the first, is powered by dual electrically driven pumps. If one hydraulic system fails, the second supplies control power automatically and immediately. The third system drives the lower rudder segment and the leading-edge flaps and is powered by a single electric motor-driven pump.

If the two main hydraulic systems fail, the airplane controls go into manual automatically and the third system drives the lower rudder. Under these conditions, the airplane is not only flyable but can be landed with manual control. The manual system provides enough power to produce a roll rate of six degrees per second, and a full flap with six elevation, but the F-17 cannot demonstrate a complete roll under this condition.

Stick Forces

Both lateral and directional control systems produce artificial stick forces or "feel" with respect to the stick. The aircraft's 10-lb. empty gives the feel at full deflection, for the rudder, the feel is 30 lb. on the pedals.

The developer has a hydraulic feedback system, based on integrated signals from the stability position and dynamic pressure, used from dual pitot inputs, electrically derived, one on each side, at the five integration of those two bits of information gives a direct representation of the center of gravity, constantly by defining the trim of the aircraft and its static stability margin for an condition of flight. If one hydraulic system fails, there is no change in lift, due to the pilot, if two systems fail, the elevator feel is produced in a spring which gives stick forces corresponding to those usually felt at 1-40 ft.

The forward cockpit shift and wind

How you can avoid three costly mistakes in the selection of a scientific or engineering computer

And the one sure way to find the computer that suits you best

Selecting a computer can be one of the most important decisions an enterprise can make. Almost any computer can perform many or all of the same functions, and some time, but some are far more efficient than others. This then should lead to a careful study of available computers. And the study must avoid becoming overclouded with "media and bytes" and concentrate instead on overall reliability and price.

Basically, the decision has to depend on the needs of the company that best serves your needs. The responsibility of solid state scientific and engineering computers has been found ideal for many leading companies. Perhaps it could best meet your needs. The following common mistakes may offer some guidance in your choice.

(1) "Get the cheapest computer"

Just as there is no such thing as a cheap car, there is no "cheap" computer. Scientific systems having computer cost from \$10,000 and up. They range from \$1,000 and up to more than \$100,000. But make sure important that what cost is how much a computer will save you over a period of time.

A computer manufacturer study showed that a Plessey computer could save almost \$70,000 more than a low-priced computer in a year or a given project in addition. Plessey offers a local area design. The Plessey 10 includes in what for small-scale needs. And yet the basic cost for the Plessey computer for medium scale needs, Plessey 10 starts at \$2,495. A complete line of peripheral equipment is available for both computers.

(2) "Buy the fastest one"

Naturally speed is important, but computer operating speed is just a small part of the story. Save a few microseconds here and there and you haven't saved much more important is total problem solving time.

The Plessey line of small and medium scale computers mark their savings in terms of hours—not microseconds. Plessey computers can save hours in problem solving time because they're simple to program, easy to operate and have an exceptionally fast recovery.

(3) "Use specialized computer personnel"

Not always necessary. Some computers do demand specialized program writing personnel to operate them. However, others are so simple to use that engineers can program their problems directly. This also of programming saves time and increases computer use.

One of the most computers in program and capable is Plessey. Engineers who less than eight hours knowledge are able to use Plessey computers profitably.

The one sure way to select a computer

The computer requirements of every company are unique. The best way to find the computer that fits your own specialized requirements—without making costly mistakes—is through a computer feasibility study. This is the only way to know exactly what computer will do what you need your own way.

Get Plessey side by side with any comparable computer on the market. Let the facts speak for themselves. You'll see why no computer feasibility study is complete without Plessey.

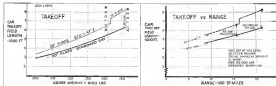
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TAKEOFF DATA (LEFT) ARE COMPUTED based on CRJ. Air Registration SR-6212; but the data are also applicable to standard 1.5 mph above an airport 1500 ft above air level. Takeoff range (right) are based on full mixed-class payload of 25,000 lb. Cruise conditions specified are close to maximum cruise with a large range of stage lengths.

should be identical to the units used for the 707 and 720. Internal arrangement is very similar to the predecessor airplanes, there are positions for captain, but neither third crewman and two observers.

Cabin construction dimensions are identical to those of the 707 and 720. Standard arrangement of the cabin offered by Boeing is a mixed layout, with 26 first-class seats forward in first-class layout, an 18-in pitch. Remainder of the cabin has 56 tourist-class seats in standard layout on 30-in pitch.

Rear Access

Rear access to the cabin is by a rear stairs, an emergency, operated from either the interior or the exterior. A door under a window is optional with the customer.

The unit can be telescoped into a compartment located below the main forward cabin.

There are two built-in compartments with a total volume of 355 cu ft with central doors 45 in by 45 in. The compartments are lined with a damage-resistant material designed for fire.

Problems of internal and external noise received detailed attention during the 727 development program. One of the most painful noise the cabin has used throughout the years of the 727 is the noise from the propellers. A first air-craft application, Boeing says. As a result of the work on the noise, Boeing shows a chart of typical reference level decibel range the cabin which points out that noise levels are below 70 db.

On the ramp, the 727 will be noisier than the 707, but quieter than the 707 120 at the 720. Actual noise level at a 200-ft radius for the thrust section is just below a calculated at about 115 db.

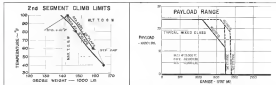
For the maximum noise level problem Boeing holds out real hope. The 727 the company says will be quieter in a substantial margin than other twin-engine jets including piston-engine types. One potential rule from the end of the runway, the 727 is expected to be making about 100 db compared with about 115 for a Douglas DC-7C, 117 for the Boeing DC-8, or 125 for the Boeing 707 120 using water injection power.

With the company committed to build the first 727 at a production aircraft rather than in a prototype, engineers planned an extensive program of tests to minimize the risk. One example of the risk. Generally there are eight engines under complete in the aircraft. In the case of the first 727 is scheduled to be delivered—February 1964—there will be more than 20 engines strong on the field, ready to go.

Test Program

Boeing estimates that \$10 million will be spent by the company on the total 727 test program. It started back in the middle of 1958 with wind tunnel tests aimed at powerplant location and configuration, and is scheduled to end in September, 1964, with the final destruction of the fatigue test airplane.

So far the wind-tunnel program time has consumed more than 1,800 hr of running time, of which about 1,700 hr was in transient testing. Biggest amount of time—about 900 hr—went into development of the high-lift devices. The most target amount of time



SECOND-SEGMENT CLIMB LIMITS (left) show that the 727 is not climb-limited at gross takeoff weight on a 1000-ft day at sea level of the plane with 20-day definition on the flap for takeoff. If climb distance can be increased, takeoff flap definition can be decreased and allow a high climb weight. That is shown by the curve plotted for 10-day flap definition and an altitude of 1,500 ft. Payload-range data (right) are presented for maximum stage thrust at 25,000 lb, conditions which would probably be used on highly competitive routes where the engine speed could be optimized.



What name is on the first 1.5 Mc recorder?

AMPEX

Here it is... a 1.5 Mc per track, multi-track recorder! And Ampex is the first to have it. It's called the FR 3400. It will give you the broadest bandwidth yet in longitudinal recording. What's more, it utilizes solid state electronics throughout—all in one rack. It has four speeds, each electrically switchable with no adjustments needed. And it comes with tape search and shuttle to provide quick data location and permit any portion of the tape to run repeatedly without operator attention. What about per-



formance? Outstanding! It offers better rise time and minimum ringing on square waves, low intermodulation distortion, and improved flutter. Ampex also brings you a new 1.5 Mc tape. In both you'll find the same engineering precision, the same superior quality, that has made Ampex first in the field of magnetic recording. Write the only company providing recorders and tape for every application. Ampex Corp., 234 Charter St., Redwood City, Calif. Worldwide sales and service.

AMPEX

Thiokol Research with High-Energy Oxidizers opens new

PROPULSION PATHS TO SPACE

WHERE SIZE COUNTS...

Thiokol's pioneering looks the size barrier on solids. Continuing R&D at Thiokol has been responsible for scores of technical breakthroughs leading to production of the most reliable propulsion systems in rocketry's current catalog.

At present, Thiokol scientists are engaged in development of new super oxidizers for solids application. A

greatly enlarged microphotograph of one of these crystalline, high performance ingredients is shown in insert illustration below. Promoting vastly improved performance—greater lift, range, and payload delivery—in rockets now flying, new Thiokol-developed oxidizers will also increase adaptability of solid systems for upper stages of space vehicles, enhance payload and reliability of big boosters.



NUCLEAR MAGNETIC RESONANCE SPECTROMETER. Advanced scientific apparatus used to determine molecular structure of exotic fuel compounds for purposes of predicting their behavior.

WHERE PERFORMANCE COUNTS...

Thiokol is testing many exotic liquid fuels for space flight. Research has already achieved several new propulsion combinations capable of providing missions of longer duration with greater payload capacity than other space vehicles and advanced cryogenics.

In actual firings of oxygen difluoride/diborane on the thrust stand, for example, Thiokol is establishing record

performance, developing ablative and/or chamber cooling techniques and defining propulsion system performance.

Thiokol

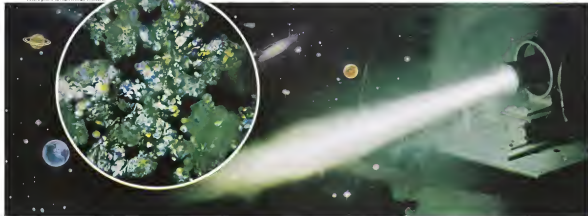
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AN EQUAL OPPORTUNITY EMPLOYER



ROCKET ENGINE. Advanced scientific apparatus used to determine molecular structure of exotic fuel compounds for purposes of predicting their behavior.

CHEMICAL CORPORATION
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Micro photo of high energy oxidizer.

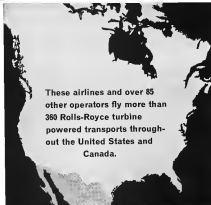


Thrust stand firing with OF₂

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AIRCRAFT ENGINES MOTOR CARS GEAR & RAILROAD ENGINES ROCKET MOTORS NUCLEAR PROPULSION

Boeing 727 All-Weather Program

Boeing has prepared a three-phase program which would develop an all-weather capability for the 727 at some time in the future. Although none of the present approaches to the subject are considered with the richness of action and actual pilots (AW Dec. 3 p. 43), Boeing feels optimistic that all-weather flying operations will come and finally be approved by every agency or company associated with it.

The basic 727 is delivered in capable of operating in reduced ceilings: 300 ft; ceiling and constant rate visibility; the company says. It will be enhanced by new training and by the improved reliability of the equipment: the improved handling characteristics of the airplane, and by accepted instrument flying displays. This operational mode is subject to approval by the Federal Aviation Agency.

Second phase, also subject to FAA approval, would take the airplane further along the path to automatic below 300 ft and one-half mile. Boeing proposes to add instrument compasses, glide slope indicators and automatic category control. It would also help to have a radio altimeter, a flare compass and automatic throttle controls and the company sees these features as to be included.

Finally, the third phase requires complete all-weather operations, meaning basic approved instrument displays, bank steering, radio aids, of criteria in parallel knowledge in type of angle failures, and are additional equipment using set of future dual operations.

ing these most into better insights too.

Engine risks were tested on the water table, a two-dimensional analogy to actual flows which reach critical quality test data can be gained. Further risk studies were made in the transonic tunnel at Boeing, the low-speed tunnel at the University of Washington, and in large-scale tests with an experimental JT3D engine on the ground.

Destruction Tests

Two complete airframes are scheduled for destruction. One of these will be the static test aircraft and is now being mounted in the test frame. Second is the fatigue-test airframe, which will not be available for test until next 1963.

Second production airplane will be returned by Boeing for flight-test work until the first group of airplanes has been delivered. Reason is that flight testing of the 720 and 720 series had to be done previous on airplane made available through the cooperation of customers. Any delivery on Boeing's part generally meant that the non-accepted test installation had to be repaired and installed in another airplane again with the customer's acceptance. This practice was the danger of the flight test equipment, but was necessary under the circumstances. The 727 program will not go the same route.

The Dash 80, going 707 prototype which has been on flight status for some time right now, was used as a flying test vehicle for two major areas of 727 development: engines and flaps. It logged almost 250 hr in these tests, and started showing wear on the brown and yellow aircraft apparently Boeing received the Seattle area, its high take-off and landing flaps and landing gear data.

fixed in place, and its low wing structure supported by a fifth powerplant, mounted like a wing on the left rear fuselage. Unconfirmed reports say the 720 stood at less than 60 ft.

Other test equipment included the "iron bird," a 50 million lb with full scale dimensions and components of the airplane's control system.

Boeing will lead to a production rate of these per month at the end of 1963, and by mid-1964 will reach a scheduled eight aircraft per month. First four airplanes off the line will go into the certification program. The following three complete the first batch and all of the first seven will be delivered to United Air Lines.

The 727 is being fed right into the same production line that are now turning out 197 and 720 series airplanes. The reason partially is one of maintaining the level of employment nearly constant over a long time period. Boeing expects and has utilized techniques working on systems installation, or final assembly, or fuselage sections, can handle any of the Boeing airplanes irrespective of type. To stress, the specific job is the responsibility, and the general airplane data on which they are working.

Steady Employment

The reason that by proper phasing of 727 production into the 720 program at Renton, the company can avoid the employment peaks and valleys that generally characterize the shift from one type of production to another.

One of the most important adjuncts to production has been the mock-up. Traditionally relegated to a side corner of a hangar somewhere, the mockup has been moved gradually as a means of improving the customer. Boeing has

custom
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are

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reliability
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Also available 25 "Three 1/2" and 1/2" relay switches specifically designed for a variety of needs, through and ground support maintenance applications. Available in 5 to 8 devices per unit in quantities of engineering, testing, inventory with a variety of power sources for remote operation. Most or exact application military requirements. Write for new "Mason" capabilities in military specifications.

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Hughes makes news in armament!

Missile breakthrough or major conflict—today's air-to-surface tactical missions require new flexibility in armament. There are a greater variety of small, hard-to-see targets which must be attacked at short range from an aircraft flying at low altitudes. Total loss to fire is shorter.

The optimum weapon in this difficult environment is the high-rate-of-fire gun. It is extremely accurate. It reacts instantly. It has high lethality against a wide range of targets. Other advantages are low cost, logistic savings, over all simplicity and reduced pilot exposure.

Gun Ordnance has been a major activity of the Hughes Tool Company—Aircraft Division for more than twenty years. This continuing gun development and production capability has culminated in advanced weapons—ideally suited for today's requirements.

Hughes gun ordnance capability includes the complete system—the gun, its installation, controls, sighting and specialized ammunition. These systems are tailored to the individual missions of fixed wing aircraft, helicopters and ground vehicles.



Hughes HUPEG—23mm gun pod—Unique in the field of aerial armament systems, HUPEG is a complete, high performance gun system. Its Mark 11 gun fires 4000 rounds per minute—the highest firepower rate per pound of all 23mm guns. It comes up to rate instantly and fires the most powerful 23mm round available. The HUPEG system contains the gun and 750 rounds of ammo in a super-strong enclosure. Developed for the U. S. Navy, it is now available for application on a wide range of fighter and attack aircraft as well as helicopters. Advantages of Hughes HUPEG: It can be removed for servicing and replaced by loaded pods for quick turn around. Alternatively, the pods can be left all to allow the aircraft more versatility in two-gun missions. HUPEG provides more rounds per aircraft—greater aerial utilization. As required, Hughes HUPEG pods can be installed in multiples to provide greater firepower density or longer duration.



Hughes ammunition developments include 23mm armor piercing rounds, specially tailored for use against ground targets as delivered from fixed wing aircraft, helicopters and ground vehicles. Also in development, a new 23mm salvo round for the MK 11 gun system area targets.



Hughes Heligan has 4000 round per minute responder at only 38 lbs. weight—seven times more firepower per gun than conventional weapons. Designed specifically for aircraft where heavier guns are prohibited, Hughes new Heligan utilizes principles proven in its 23mm counterpart—the HUPEG. Using the T 63mm NA10 round, the Heligan will provide dense firepower from helicopters, fixed wing aircraft or ground vehicles. Features include: Self power. Instantaneous rate. Low frontal area. Positive protection from cockpit, hangfire and double feed. Pneumatic or cartridge charge, low velocity ammo feed from standard M13 links and only 190 lbs. average weight.

Helicopter Armament Systems—Hughes gun pods—designed for LOH use—can also be easily adapted for other helicopters. One package has a pair of M60 machine guns and offers, vibration control, quick installation, low drag, special gun sight. Alternatively, the new Hughes Heligan could replace existing guns to offer a fourfold increase in firepower and a five times reduction in drag. A fixed wing version would position the Heligan in an external pod. An interchangeable package contains the XM-73 grenade launcher.



4 Hughes HUPEG 23mm Pod with MK 11 Gun (4000 rounds per minute firepower) gives the Navy's AD aircraft a firepower against small targets such as tanks and other ground vehicles.

Twenty years of experience applied to expansion of the state of the art... complete engineering laboratories, enclosed firing ranges and manufacturing activities in one compact facility. These are the factors which have made Hughes major as a producer of advanced armament for free world defense. Individuals with a need-to-know are invited to request further information. Please contact the Vice President-Marketing, HUGHES TOOL COMPANY, Aircraft Division, Culver City, California.



VIBRATION NEWS

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MB's T-388 Automatic Equalizer cuts equalization time to 5 seconds...

Production random vibration is now practical with MB's completely automatic spectrum equalizer. Set up time is eliminated and equalization required within 5 seconds. Savings in test time and labor for static and aircraft manufacturing can easily reach many thousands of dollars per machine tested.

Operation of the T-388 automatic equalizer is extremely simple and can be readily handled by non-technical personnel. A flat or shaped spectrum is easily programmed on the spectrum control panel by setting the slide wires. A template of the spectrum can be used for the



Template of your test spectrum can be used for rapid set-up of the T-388 automatic equalizer.



setting as shown above. The equipment does the rest.

The T-388 also provides higher test accuracy and versatility. Equalization to $\pm 1\%$ db is obtained and equipment automatically compensates shifts in resonant frequencies and changes in amplitude. Normal frequency range is 15 to 3000 cps in 20 cps bandwidth, exp 3000 cps bandwidth can be obtained between 15 and 10,000 cps by simple front panel selection.

Other unique features of the T-388 Automatic Equalizer include:

- Spectrum analyzer has 3 types of readout: 1) precision, direct

reading in g/eps; 2) visual display on scope for continuous monitoring; 3) permanent record of test using X-Y plotter.

• Highly accurate equalization through the use of 80 distinct channels of narrow bandwidth (25 cps) covering a 3000 cps band.

A test laboratory equipped with the T-388 will not only save many hours of valuable test time, but will also be prepared for present and future test requirements.

For detailed information on the T-388 Automatic Equalizer write to MB Electronics, 712 Whiskey Ave., New Haven 55, Conn.

See 80 Multi-Filter Equalization Systems purchased by leading test laboratories

The important information which the MB Multi-Filter Equalization System makes the most of vibration testing has been made public by leading test laboratories. In the past 10 years 80 units have been purchased a remarkable record for equipment of this type. All major tests and quality control tests are now made in many test labs in many different parts of the world. The MB Multi-Filter Equalization System is now the product.



YH-51A Wind Tunnel Tests

Full-scale model of Lockheed YH-51A night-vision helicopter has completed initial wind tunnel tests in the 40 x 50 ft. tunnel at the Ames Research Center of National Aeronautics and Space Administration. Tests on the body and tail section provide vital information of flow pattern during test operation. More advanced stall tests and stability for cruise control are the next. Lockheed system was previously flown from the rotor and the stabilizing has to improve the dynamic stability of the helicopter. Aircraft currently under test flight (AM-26, p. 27) but a complete test vehicle has been flying for a period of more than one year.

lockers with hushers long ago on the subject. There is a calm mood, which is expensive, and which is used safely at maximum, but there is a huge task as well, complete with its own shop and highly skilled technicians available to study even, considerable problems that can be reduced to the mechanics of engineering or production.

The company has three classes of mock-ups:

- Class 1, for the study of specific engineering problems. This can be, and frequently is, the physical and functional type of mock-up.

- Class 2, for working out the overall design features, generally as an engineering aid.

- Class 3, for studying production problems, developing them for the line, and as a major manufacturing tool.

Major use of Class 3 mock-ups comes in the fitting of sections into the airplane, using old plywood or two of the steel applications here.

Manufacture of the 777 program is on a functional base, with manufacturing, finance and engineering personnel reporting to the Transport Division manager. Program management is a staff function within the division, staff are assigned to the 777 project, but continue to report to their functional groups. The project group at the staff level gets its support from manufacturing,

stress, light test and the other functional groups in the division.

The 777 program manager reports to a division vice president, a level high enough and a more direct enough to get things done.



Vibration Exciter

Hydraulic shaker exciter has been mounted in new section of No. 1 prototype of the 40 x 50 ft. tunnel. Three jet transport, new workshop construction tests at Hatfield, England. Second section is being installed in tail section. Devices are used for flutter testing and speeds will be extended up to 100 ft. during the phase.

FREE TO COMPANY OFFICIALS LOOKING FOR A NEW PLANT SITE

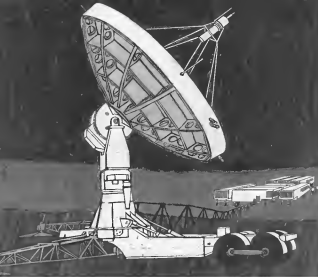
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TAILOR-MADE. This confidential report is not taken off the shelf. It will be prepared specifically for you, based on the requirements for your new plant as you give them to us. Send these requirements to your business letterhead to Commissioner Keith S. McHugh, N.Y. State Dept. of Commerce, Room 211K, 112 State St., Albany 2, N.Y.

Keith S. McHugh

Keith S. McHugh, Commissioner
New York State Department of Commerce



The SYNCOM ground terminal story. It is a moving one.

The SYNCOM experimental satellite will employ surface terminals that have no permanent location. They can be moved as often as necessary. That's a unique feature about Project SYNCOM. It's our job to design and construct the mobile ground facilities under contract to the U.S. Army Electronics Research and Development Laboratory.

Bendix Radio's participation in Project SYNCOM—a NASA-led program in which the U.S. Army Satellite Communications Agency has responsibility for surface terminals and communications testing—is a typical example of our capability in the fast-moving communications field. Bendix Radio's experience and performance in developing equipment for fixed ground stations and shipboard terminals for the military communications satellite program helped lead

to our selection by the Army to participate as a prime contractor in the NASA SYNCOM project. Project SYNCOM is to demonstrate the feasibility of communications between surface stations via a lightweight satellite in a 24-hour synchronous orbit at the 25,000 mile high altitude.

The SYNCOM ground stations in some respects represent a state-of-the-art Super High Frequency equipment development. This development also provides basic air building blocks for consideration in other advanced Government-sponsored programs.

Take advantage of our experience and continuing development costs in communications systems by contacting Government Sales, Bendix Radio Division, The Bendix Corporation, Baltimore 4, Maryland.

Bendix Radio Division



Despite radical changes from performance, including one swapping of engines and a different wing, the Boeing 717 retains modified Boeing look. A total of 131 aircraft have been ordered by NASA and the



Integral vented boarding stairs will open into coach section of the floor cabin, short transverse range cabin. Forward door, which can be equipped with integral loading system, opens into first class compartment.



*7,000 gal. titanium tank
for liquid hydrogen
built by Beech Aircraft*

Data now available on **Titanium's** cryogenic properties

Titanium can hold more liquid hydrogen at less tank weight than any other material and still give you impermeability to hydrogen, generous elongation and notch toughness at -423°F .

Some specifics. The liquid hydrogen tank shown here was built and successfully hydrostatically tested by Beech Aircraft Corp. Capacity, 7,000 gallons. It was fabricated from sheet supplied by Titanium Metals Corporation of America to less than AISI tolerances, in thicknesses ranging from 0.004 to 0.025 inches.

Cryogenic alloys. The alloy used was Ti-6Al-4V ELI, one of two alloy grades advanced by TMCA specifically for liquid hydrogen service. The other grade is Ti-5Al-2.5Sn ELI. The designation ELI stands for Extra-Low Interstitials. Typical properties of these grades at -423°F :

Ti-6Al-4V ELI: tensile strength, 263 ksi, yield strength, 248 ksi, notch tensile strength, 211 ksi elongation, 7%.

Ti-5Al-2.5Sn ELI: tensile strength, 229 ksi, yield strength, 206 ksi, notched tensile strength, 233 ksi, elongation, 15%. Compare these properties with stainless and aluminum. You'll see why titanium guarantees more payload!

They count on TMCA, the nation's only firm devoted exclusively to titanium and the only company providing the full-time, comprehensive technical service you require. Phone, write or wire TMCA for cryogenic data today.



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Piasecki 16H helicopter is currently being tested with wings in combination with rotor system. Addition of wings allows the vehicle added speed, range and stability. Note USAF B-47 in lower background at Philadelphia International Airport.

Piasecki 16H Tested in Wing-Rotor Combination

Powered by a General Electric and Whitney TF41 turboshaft, 16H's digital perfomance counter turbine features no burning and provides propulsion during cruise phase. 16H has five seats. Shown below, vehicle has rotor blades and wings folded in parking configuration.





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DC-8's are the first pure jet freighters. And they carry cargo at fastest speed and lowest cost per ton mile in aviation history.

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C-124's are the mainstays of our military global supply system; did yeoman work in New Line deliveries; supplied the South Vietnamese during the Korean conflict.

DC-7's play a major role in airframe freight operations.

C-119's and **C-54's** were the Air Force's workhorses during the Berlin Airlift...showed the

dependability built into Douglas transports. **DC-6A's** were the first to break through the high cost barrier to the expansion of air freight.

C-47's were the mainstays of our World War II military supply effort; saw "the hump" regularly to keep our life-lines to the Far East open.

DC-3's are characteristic of what can be expected of all Douglas transports...more than 3500 commercial and military versions are still flying after 25 years of rugged service.

It all adds up to this conclusion: for transports that perform better, last longer, maintain easier, and stay in there when the going is rough, you can depend on Douglas.



DOUGLAS BUILDS GREAT TRANSPORTS

DOUGLAS  **AIRCRAFT DIVISION**

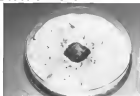
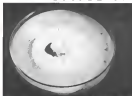


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SPACE TECHNOLOGY



VARIOUS FUNGI STUDIED BY AVCO'S RAD Division include penicillium, above left, aspergillus oryzae, above right and aspergillus terreus, below left. Below right is a culture of penicillium photographed by its own light. (Photo was a three-hour exposure with No. 105-AP gyrocgraphic film. Magnification is four times.)



Fungus Is Studied as Radiation Detector



LIGHT TIGHT BOX, left, holds trichoderma fungus and photomultiplier tube. Signal from tube is amplified and recorded on the instrument at right.

Certain types of fungus may be used by future space pilots to indicate radiation levels within their spacecraft, just as miners once used canaries to detect gas in mine shafts, if research now under way at Avco Corp. should prove the concept to be feasible.

Using two species of fungus—*penicillium* and *aspergillus nidulans*—current part of the work ranges of radiation into basement light rather than heat, Avco's Research and Advanced Development (RAD) Division, Wilmington, Mass., is attempting to correlate the effects of such factors as radiation, temperature, shock, vibration, acceleration, sound, partial pressure, oxygen and moisture concentration on the responses of these sensitive plants. Effects are indicated by changes in fluorescence of the plants which is detected by sensitive photomultiplier tubes. Each sort applies one of the fungi.

The giant RIFT vehicle: it will pioneer nuclear-propelled space flight

To propel its spirit ships through the far reaches of the solar system, the National Aeronautics and Space Administration is studying new kinds of power. NASA feels that nuclear propulsion may be the key to space exploration. It has chosen Lockheed Missiles & Space Company to design and build the nuclear stage of the giant vehicle that will demonstrate the feasibility of nuclear-propelled space flight. As NASA's industrial partner, Lockheed shares the management, scientific, and technical responsibility for the RIFT (Reactor-In-Flight-Test) program. The primary purpose of the RIFT vehicle is R & D. It will help the NASA/Lockheed team develop design data for even more advanced nuclear-stage systems. Yet so great is its promise that Lockheed is designing R for possible use as a stage atop one of its own advanced boosters—the 7½-million-pound-thrust Advanced Saturn.

LOCKHEED'S MISSILES & SPACE COMPANY Lockheed, Corporate & Space Products of Lockheed Aircraft Corporation

Photographed in testbed settings, each member of the RIFT vehicle team is right now the Lockheed tool nuclear stage will be able to test at NASA's Nuclear Reactor Development Station, Lockheed Palo Alto Research and Development Center, compatible with new crew ship the Advanced Saturn booster.





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MICRO SWITCH "AT" TOGGLE SWITCH ASSEMBLIES



The "AT" Toggle Switch Assemblies illustrated here are just a few of more than 100 assemblies designed to operate from one to a dozen miniature precision snap-action switches. This Series provides a broad range of circuit combinations in electronic, aircraft, mobile and marine applications where reliability and panel space economy are essential.

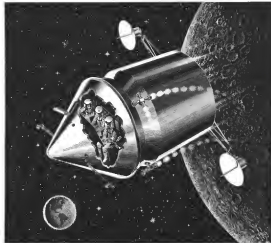
In the Series are 2 and 3 position toggles, maintained

and momentary lever positions, pull-to-unlock lever/spring levers, and special features such as an "electric memory" unit and "dry circuit" capabilities. All are manufactured with MICRO SWITCH precision—the precision that means long life and reliability. For engineering service look for our Branch Office in the Yellow Pages. Or, write for Catalog 73.



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IN AEROSPACE, MARQUARDT MEANS...

Reaction control engines for Project Apollo

Marquardt is currently engaged in the development and fabrication of the reaction control rocket engines for the service module of the Project Apollo Spacecraft—The National Aeronautics and Space Administration's initial manned expedition to the moon. The Marquardt engines in the service module are part of the flight and stabilization control system, providing attitude control and stabilization enroute to the moon and back, and during lunar and earth orbit.

Marquardt has successfully designed and built advanced control systems for aerospace vehicles for nearly two decades. Absolute reliability and precise accuracy are necessary for satellite navigation, station keeping, orbit control, landing and lift-off from distant planets. Reaction control

systems by The Marquardt Corporation are relied on to do these vital jobs.

Engineers and scientists interested in joining Marquardt on Apollo and other significant aerospace projects are invited to direct requests to Professional Personnel at the address below.

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This lightweight, battery model of the North-Sighting Gyro is a third-generation system incorporating the refinements of our five years of active development at LSI/ASTRONICS in several different models of the North-Sighting Gyro. This particular model is adaptable to a wide variety of applications that need accuracy in seconds at all times, without expensive calibration or maintenance of the device at a price into \$1,800 per set.

Ideally suited to both tactical and strategic support, the North-Sighting Gyro can be provided with either a theodolite head for manual operation or a self-aligning unit that permits automatic operation for target angle traverse—usually automatic. Applications include: Technical Field Support • Head Site Aiming Back up • Station Platform Alignment. For additional engineering data please write Dept. AWT 1983-1.



200 SOUTH ROYAL DRIVE, SANTA ANITA, CALIFORNIA

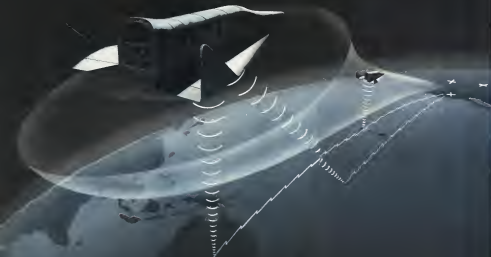


Saturn Complex 37 Construction Advances Rapidly

Saturn Complex 37 at Cape Canaveral, Fla., during view seen above, during at right is at an advanced state of construction and the first of its two launch stands is expected to be finished in the spring of next year. National Aeronautics and Space Administration's Launch Operations Center will begin checkout of pad B (left) immediately after acceptance of the shuttle from the Army Corps of Engineers. Pad A (right) is not expected to be completed until next year. Its construction has not been pushed as hard as that of B, pending decisions on the introduction of the Saturn C-1B vehicle (AV) July 2, 1981 into the overall launch vehicle program and the planned frequency of Saturn C-1B launches. C-1 vehicle counts of 5-1 first stage and 5-4 second stage, C-1B requires a Block 2 S-1 booster and S-4B second stage. If a heavy schedule is laid out for the C-1, then both A and B pads of Complex 37 would be used for that vehicle and a separate launch complex would have to be built for the C-1B. If the C-1B is introduced early, then pad A will be modified slightly to accommodate it. Between the two 260-ft tall umbilical towers at pads A and B is the 235-ft tall launch access structure. Reinforced, the service structure incorporates a series of longed forms which can be closed around the vehicle as it is mated on a pad. The 50-ft, boom atop the structure has a 48-ton lift capability and will be used to hoist stages on to the launch pad and the 1st of the tower. Liquid hydrogen and liquid oxygen storage tanks have been installed, each with a 125,000 gal capacity.



TRAFFIC PATTERN.. HALF A WORLD LONG



The Problem . . . Space Vehicle Recovery

How do you guide a manned, maneuverable recovery vehicle to a routine landing . . . from 300 miles up, 10,000 miles out?

What are the basic system requirements, the operational concepts of a Recovery Control Center? What limits and tolerances will exist for each stage of the recovery process (re-entry, hypersonic flight, terminal approach, etc.)? What are the flight parameters, the human factors? What is needed in the way of vehicle energy management, ground guidance, range instrumentation, data processing, data handling, display, communications, trajectory analysis, information flow analysis?

For over three years a Raytheon team led by R. L. Schroeder and John Zvara has been investigating these and other recovery problems. Primary emphasis has been placed on NASA's Gemini and Apollo, USAF's X-30 (Dyna-Soar), SLOMAR, and recoverable booster programs.

Result: A unique conceptual techniques capability. Understanding of what must be done to make a Recovery Control System work. Allied experience in real-time data processing and display concepts, and hypersonic vehicle guidance.

Schroeder, Zvara and other Raytheon scientists have published many technical articles on recovery control requirements, problems and concepts. We have collected a number of these and bound them under a single cover. If you would like a copy of this comprehensive document on system requirements for manned space vehicle recovery, write: M. B. Carnia, Dept. GM 13-6R, Raytheon Co., Lexington 73, Massachusetts.



Raytheon's John Zvara (left) and R. L. Schroeder

RAYTHEON



Can you think of a more punishing test for landing gear reliability?

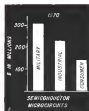
Bringing a plane down on a carrier deck calls for a lot more than an ordinary amount of strut strength. Nevertheless, the durability demonstrated here is designed into every strut we build—whether it works up on a carrier-based fighter or a land-based bomber.

That's one reason our struts meet the most exacting en-

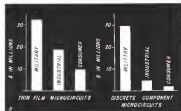
gineering specifications. One reason Bendix supplies struts for so many military aircraft.

Bendix struts are built in strength, light in weight. They are designed with special emphasis on durability, reliability and economy. May we tell you more? Write to Airframe Equipment Sales Manager, South Bend, Indiana.

Bendix Products Aerospace Division



SALES FORECASTS for three types of microcircuits in 1970 reported by three firms made as industry sponsored survey conducted by Stratford Research Institute, industries report integrated components on electronics industry during the present decade. Total semiconductor microcircuit sales for 1970 are estimated at \$650 million (left), thin film microcircuits at \$61 million (center) and discrete component microcircuits at \$17 million (right). Right aerospace and defense companies sponsored the survey.



Report Sees Semiconductor Dominance

By Ben Miller

Meeks Park, Calif.—Semiconductor microcircuit and hybrid devices using semiconductor materials are predicted to be the dominant types of microcircuit in use in aircraft equipment by the end of this decade. These microcircuits will continue to be made and applied by semiconductor component manufacturers and by equipment makers on a wide scale.

These are two of the principal points from a comparative industry study recently completed by Stratford Research Institute, Inc. The \$100,000 study, sponsored jointly by eight aerospace and systems companies—Boeing, Avionics Engineering Electronics, Convair, Decca, Radio Division of General Motors, General Purpose, National Civil Regulator Division and Sperry Rand—is tackling answers to the rising problems created by the advent of microcircuitry (EW Mar. 18, p. 55).

Expanded "Trends of Integrated Components on the Electronics Industry 1960-1970," the study's objectives are:

- Extrapolating the present market
- Forecasting marketing trends
- Identifying types of actual applications which will be fed in one large quantity of integrated components
- Describing progress being made in the concepts, new technologies and developments
- Describing the effects on supply-demand relationships
- Determining strategies of action on the economics and other key factors influencing the decision to design with integrated components

- Discerning probable changes in methods of assembly and interconnection
- Comparing marketing approaches
- Identifying component SKI data from the component in part, the performance as well as functions not performed by conventional components. In addition, the definition of integrated circuit is restricted to devices capable of achieving packing densities in excess of 100,000 parts per sq. in., thus distinguishing it from quartz crystals (The integrated component is what American Whitt & Sons, Torrington, Conn., in the absence of any accepted industry standards has been identifying (EW July 9, p. 46) as a microcircuit).

SKI also has been integrated component generally to describe the following three types:

- **Conventional assembly**—This type

uses conventional components soldered or welded to supporting structures in one of many packaging techniques, such as the conventional MicroModule, mini-chip and pellet approaches (AVIATION WEEK has identified the conventional assembly as a discrete component microcircuit).

• **Passive substrate assembly**—This is the standard substrate with individually deposited passive components. Active elements transistors and diodes are attached (This is the thin film microcircuit).

• **Active substrate assembly**—This consists of active (semiconductor) substrates with active elements typically diffused into it and either diffused passive elements or thin films deposited over its etched surface (This is the semiconductor microcircuit or a hybrid version of it).

Richard H. Randall of Stratford Research's Division of Economics Research discussed the objectives, definitions and methodology of the survey, but he declined to disclose on the results of the industry's efforts. Many of the results of the study were learned in industry, however, from time of the 200-100 people in 50 organizations, sponsored as integrated components, and reviewed during the past year by Stratford Research participating firms.

Survey forecasts electronic equipment sales of \$19.1 billion in 1970 leading down into \$11.3 billion for military, including National Aeronautics and Space Administration, \$16.6 billion for industrial and \$2.6 billion for consumer markets. Of this total, integrated components are expected to account for



DIVISION of the total projected electronic equipment market in 1970.



Modular design for 10-second circuit replacement...

Terminal bases snap on and off the supporting rail. Any circuit can be removed, replaced or added, using two standard tools, in only 10 seconds. No other circuits are disturbed. No need to disassemble the entire block.

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\$775 million, roughly 98% more than the annual sales of all semiconductor components by American manufacturers for year-69 more after the revision of the statistic. This figure compares favorably with figures cited by Robert C. Spangue (AW Mar 18, p. 28) at the National Electronics Components Conference where he estimated a \$465 million market in 1969 doubling by 1972.

Active substrate assemblies, according to these projections, will account for the largest slice of the \$775 million market approximately \$680 million or roughly 87.5%. This estimate corresponds qualitatively, similar to the percentage breakdown is contained, with the ratio of some equipment and its basic manufacturers surveyed earlier this year (AW Mar 19, p. 55), who indicated that industry that semiconductor would be dominated by a semiconductor-based industry.

Market Breakdown

Then this market would be larger than those allotted to passive substrate assemblies as they would be used in hybrid combinations on active substrates. This is not readily reflected, however, in these figures since the hybrid device using a semiconductor substrate is lumped into the active substrate assembly category by definition. The likelihood that techniques of encapsulating active elements on passive substrate would speed technical maturity in this decade apparently has been ruled out.

Breakdown for the three types of integrated components according to their end market for 1970 is as follows:

Commercial assemblies (discrete component microcircuits)

- Military—\$30 million
- Industrial—\$3 million
- Consumer—\$2 million

Passive substrate assemblies (flex film microcircuits)

- Military—\$33 million
- Industrial—\$33 million
- Consumer—\$10 million

Active substrate assemblies (semiconductor microcircuits)

- Military—\$518 million
- Industrial—\$270 million
- Consumer—\$148 million

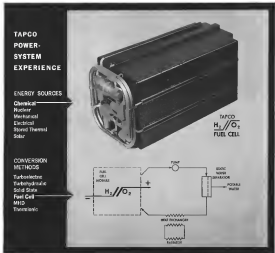
If these figures are an adequate projection of the approximate percentage breakdown of the market among the three general end market categories, the military market, as expected, would be the largest single one, accounting for 65% of the total.

Of the total 1970 military electronic market reportedly projected by SRI, NASA's requirements account for a sizable portion—26.6% or \$137 of \$511 billion. Other share in billions of dollars include: aircraft \$18, satellites 1.6,



TAPCO
Thompson Ramo Wooldridge Inc.

POWER SYSTEMS BY TAPCO—Basic materials and components research combined with the development and testing of more than twenty different energy conversion systems and the production of several thousand flight-worthy units provide the background for another space system from TAPCO.



HYDROGEN-OXYGEN FUEL CELL POWER SYSTEM. Now under intensive development at TAPCO, a multifuel, self-contained system for manned and unmanned space vehicles. Nominal 200° F. operating temperature provides the versatility for orbital or lunar day-night operation. System consists of compact 6.5 cu ft, lightweight, 1 KW modules having quick start up at 90% full power, low pressure operation and 50% 70% efficiency. Each module contains dual gas burner fuel cells, manifolds, controls, heat exchangers and static portable water separators. Featured in the design are high current density with high cell voltage, reliability and long life, freedom from problems of voltage fluctuation or membrane degradation. TAPCO, a division of Thompson Ramo Wooldridge Inc., 23855 Euclid Ave., Cleveland 17, Ohio.

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TARGET: Operation Leapfrog

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Concept: New and daring. Based on the sector assembly of high-energy solid propellants, and the high mass ratios possible with Spindly® glass filament-wound structures.

UNLIMITED POTENTIAL. This is a concept for producing boosters of virtually unlimited size and thrust. One, for example, which, utilizing 10 cell-in-pounds of solid propellant in 408 sectors, would develop a thrust of 50 million pounds—enough to put 300 tons in low-earth orbit, or to boost a manned expedition to Mars and back.

EXTENSIVE CAPABILITIES. A proponent of Hercules origin, the concept draws on existing facilities of many producers throughout the nation. Propellant is manufactured at present with each sector limited in size only by transportability. Sectors are delivered to the assembly site and stacked in position.

FAST DEVELOPMENT. Assembly is completed when the resin-impregnated glass filament is wrapped around the stacked propellant. This operation, too, calls on standard procedures—rotating only a basic mechanical motion. Its adaptability to experimenters such as this—150 feet by 35 feet—is merely a matter of development at the launch site.

HERCULES CAN DO! For those who believe, as Hercules does, that the space race is easily and simply a thrust race, we have compiled confidential documentation of our concept and its proposed programing. For details, write: Chemical Propulsion Division, Hercules Powder Company, 910 Market Street, Wilmington 90, Del.

HERCULES
TRUST IN CHEMICAL PROPULSION

diaphane equipment 0.5 micron-wavelength and R&D 4.

About 117% of all military active element groups will be using integrated components by 1970. The study is designed to indicate: By active element groups: SSI signals on a transistor or tube with associated groups of passive components.

By the end of the decade, any of the three categories of integrated components will be able to satisfy half of the military weapons and, N-USA requirements. The remaining half can be met by conventional active element groups. Survey results indicate that the development and fabrication of active assemblies will not with stand in today's semiconductor component industry as it does now with their transistor and diode processes.

In-House Capability

Only about 28% of electronic equipment manufacturers are reported to indicate that they expect to have an in-house capability for making active substrate assemblies by 1970. The remainder appear to prefer selecting modules from active-wireless sources.

Of 30 selected electronic equipment manufacturers, about 60% had some in-house development activity as just one element. None of the 30 had any in-house active substrate capability, although 40% of the total were said to report such activity in process at other facilities operated by their organizations. These results also tend to suggest that the next place to bet for active substrate assemblies lies in silicon, and certainly indicate no near-term trend toward in-house active substrate capability.

High percentage of in-house passive element effort in the preceding sample



SEMICONDUCTOR MANUFACTURE are expected to have the largest share of active element market in 1970 with 87.5% (A), followed by thin film manufacturers (B) with 7.75% and discrete component manufacturers (C) with 4.75%, according to recent study of the industry.

might be interpreted as a number of years. Although the study of the 1970 comparison of industries, many attributes and various capabilities/systems comparison (General Dynamics/Astronautics, Los Angeles; Spindly/Astronautics, Lockheed Aerospace & Systems, Burbank, Calif.), to ascertain if they have developed extensive than 20% capability in the past several years.

Varied Motives

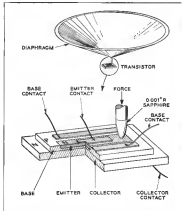
Three motives stand from a preference for this as a microwave technology to the belief that active element substrates would not progress as rapidly as they have in the past two years. A major reason is the lack of integration along the active substrates with active elements defined as these and then in-house tailor depending the present components in most particular needs. In respect of integrated components on the electronic industry will be left more centrally in the second half of the decade than it will be in the first, Randall points out. SSI's study indicates, he explains, that the most rapid growth in integrated components will come after 1965, despite the optimistic sales estimates for the next several years sometimes published by industry representatives.

Digital field will be a principal application area of integrated events, the survey indicates. Digital applications require large numbers of single types of devices in which passive element interconnections need not be tight. This is particularly inviting to active substrates, and the possibility of quantity size premium increased yield and reduced price. Active electronic modules' particular suitability for digital applications, the study is reported to suggest, poses the possibility that circuits capable of redesign could be synthesized in digital, rather than hardwired.

Component Business

Emergence of integrated components may have its greatest impact in the component business, especially on the passive component manufacturer whose market will be curtailed in both active and passive substrate assembly unless active passive elements in semiconductor or with thin film (AW Mar 9, p. 15). SSI estimates that \$100 million will be shared from the sales of both active and capacitor sales projections for 1970 as they are edged out by integrated components.

In the SSI survey, Randall explains, the industry attempted to estimate the penetration of each type of integrated component in terms of its technical capability for that decade, whether the projected cost savings could and would result from their construction and whether they would be suitable for volume of size, weight, reliability, and



Bell Develops Semiconductor Microphone

Semiconductor microphone: more than four times as sensitive as carbon type and using only 3 Vt as supply current, has been developed by Bell Telephone Laboratories based on piezoelectric property of semiconductor. Diaphragm vibrations are transmitted to thin junction on transistor by sapphire spire. Device has speed to sense rise of 94 db in sound pressure of one decaying cm in a frequency of 1 kc. Device's tiny size opens up many possibilities. Resilient, unattended, smaller type device at Wisconsin is being developed.

shells, number of shelled gauges, etc. SRI found that there is room to expect improvements in reliability and reduction in cost over conventional components and packaging techniques, as recognized component advances have suggested, stressed.

Factors relating to cost that are of concern to potential users of integrated components include the displacement of engineering and assembly labor, the displacement of field maintenance (Bosch is the contract seller to be paid to reduce field maintenance) and the extent to which the supplier must reduce his price before integrated components become attractive to the user.

Surveying possibilities for integrated component application is reflected in SRI estimates of the consumer sites of electronic equipment in 1970. The market for television receivers alone is projected to be \$460 million (plus \$136 million, records and tape \$263 million,

phonographs \$190 million and stereophones \$370 million).

As for the validity of the market price tag projected by the study, Rosdill concludes his confidence in the estimate stands as strong as it did a decade, for which matter has already been conducted.

Survey Team

Four SRI staff members acted as a part-time SRI lab, which conducted the survey. They collected data from component manufacturers, from assemblers of electronic equipment, from research and development organizations and from industrial associations. Data resources were employed in the survey and the study team relied heavily on the counsel of consultants at the institute who have been engaged in integrated component research and development for many years.

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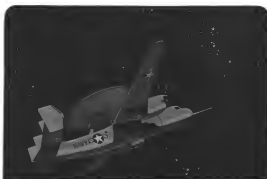
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DALMO VICTOR EXTENDS NAVY'S "SEE" AT SEA "Rotodome" antenna system, a Dalmo Victor development, is a key factor in the early warning system that gives the fleet increased threat detection and weapon deployment. The "Rotodome" antenna structure combines aerodynamics, plastics, electromechanical and mechanical design concepts into a single unit which is an integral part of the carrier-based Grumman Hawkeye. The super-sensitive, long-range detection equipment is another example of Dalmo Victor's fully integrated systems capability. Dalmo Victor is in the vanguard of new developments in its major product areas. If you are interested in becoming a part of these challenging programs, Dalmo Victor is currently seeking applications from qualified scientists and engineers. For further information contact: Director, Scientific and Engineering Personnel, An Equal Opportunity Employer.

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strength steel plate with 3" thick hemispherical ends. All welds are X-rayed and back is stress relieved and factory tested at 50% above rated pressure of 486 pounds per square inch. Finally, it is cleaned for oxygen service, sealed and shipped ready for installation.

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PITTSBURGH-DES MOINES STEEL COMPANY

New Material Laser Operated Continuously

Continuous operation of the seventh dimensional pulsed ruby laser, which processes hot metal operated on one-
pulsed basis, has been accomplished by International Business Machines Corp.

The firm's Therm-a-Laser 1a laser has achieved infrared radiation output power levels of 10 to 25 mw with applied power of 50 mw. It now produces at 100°C but not all of the desired radiation was reflected-like characteristic of a laser. Radiation was produced at a wavelength of 6,668 angstroms using a resonant cavity of 100 microns per square centimeter about 1% of the resonant density in the excited pulsed gallium-arsenide laser (AWW Nov. 5, p. 40).

The Massachusetts Institute of Technology's Lincoln Laboratory, which first reported remote induced radiation from a gallium arsenide diode, and Bell Telephone Laboratories, which built the laser laser pump, are both expected to report advances in the new type of semiconductor diode in the near future.



Mobile Tracking Lab

Mobile infrared tracking measurement is becoming designed in Range Engineering Co. Inc. Deutsche Forschungsanstalt für Luftfahrt West Germany's equivalent at NASA, can be used to obtain infrared signature data on aircraft in flight, vehicles. The mobile laboratory includes automatic infrared radar to follow target plus calibration for measuring infrared radiation.

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► **Unicon Carbine Bars Laser Activity**—Unicon Carbine Corp. is purchasing the Applied Physics Laboratory of Quantatron, Inc. from Allied Chemical Corp., following months of negotiation for the laser system first reported by *Aerospace Week* (AW Jan. 16, p. 24). The laboratory will be set up in a Unicon Carbine affiliate, to be called Koral Corp., headed by Dr. Theodore Miron, who was in charge of laser activities at Quantatron. Dr. E. L. McCordless formerly with Unicon Carbine will be vice president. The new company will concentrate in laser materials, a commercial high power laser device and laser applications and engineering. Koral is expected to continue about \$100,000 in government R&D laser contracts. It will share occupancy of the Quantatron facilities in Santa Monica, Calif. with the latter's microwave group which is expected to vacate the premises at a future date.

► **GE to Develop Nuclear Alternator**—General Electric Aircraft & Control Systems, Johnson City, N. Y., will develop low-voltage alternator which uses radioisotopes placed along the stator and a nuclear reactor in the aircraft. Work is sponsored by USAF's Aeronautical Systems Division under a \$14,000 contract.

► **The Response to Water-Fusion**—point-beam radar, under development by Raytheon for Air Force to measure radar signature of reentry bodies, is reported to be able to track objects as small as a baseball at a distance of 1,000 mi. Known as RAMPART (radar induced measurement program for analysis of reentry targets), the radar will use a 50-ft. dish and have a peak power of 24 megawatts. High speed tracking and data processing units will permit radar to make 100 measurements per second. Raytheon Air Development Center is sponsoring development under contract expected to total about \$4.5 million.

► **LEF Develops New Type Paramp**—New class of low-noise parametric amplifier using multiple active elements which enables it to amplify at signal frequency, considerably higher than pump frequency, has been developed by Laboratory for Electronics, Inc., Boston. Technique opens the way to operating parametric amplifiers at as much higher microwave frequencies. Demonstration models amplified at 10 mc using pump frequency of 7.4 mc, and at 13.1 mc using a pump frequency of 9.6 mc. Next step in pro-

gram is to obtain amplification at 13.3 mc using a 5.6-gc pump, comparing noise

► **RCA Wins Midas Tube Pict-Con**—contract to develop about 24 18-watt 5-hr-rated tracking wave tubes for use in the stationing aboard the Midas earth data satellites was won recently by Radio Corp. of America's Astro Electronics and Harmon Tube divisions. Harmon will make the tubes, Astro the power supplies and electron beam power sources from Lockheed Martin and Spac. Co. prime contractor for the Air Force's Midas station, will run about \$1.5 million.

NEW AVIONIC PRODUCTS

► **Instrument** which measures the operating parameters of power output components by first measuring their impedances and then converting this value to analog voltage suitable for go/no-go comparison or digital voltmeter display. Instrument will measure capacitance, displacement, inductance, resistance, impedance, leakage current and resistance. Manufacturer: Fairchild Semiconductor Corp., Instrumentation Dept., 545 Wisconsin Rd., Mountain View, Calif.

► **Computer, lowest cost**—single computer, Model AD 2.247B weighs 125 lb., sells for under \$3,000 in basic configuration. Modular construction permits expansion to 25 amplifier inputs and addition of interchangeable modules and clock function generators. Computing speeds of 0.025 to 1,000 sec. can be selected. Annular is quoted at 0.27% per amplifier and 0.015% per module. Manufacturer: Applied Dynamics, Inc., 2275 Platt Road, Ann Arbor, Mich.



► **Tunable C-band parametric amplifier**, with tuning range of 3.4 to 5.9 mc/sec, and a fixed pump frequency of 17.5 mc, offers maximum bandwidth of 10 mc with 17.5 db gain over noise range. Typical maximum single sideband noise figure is 3 db, including waveguide dissipation, according to manufacturer. Space Microwave Electronics Co., P.O. Box 1828, Clearwater, Fla.

► **Variable C-band parametric amplifier**, with tuning range of 3.4 to 5.9 mc/sec, and a fixed pump frequency of 17.5 mc, offers maximum bandwidth of 10 mc with 17.5 db gain over noise range. Typical maximum single sideband noise figure is 3 db, including waveguide dissipation, according to manufacturer. Space Microwave Electronics Co., P.O. Box 1828, Clearwater, Fla.

► **Tagged quartz delay lines**, which permit addition of multiple inputs and outputs with operation up to 18 mc/sec, are available with tips at rate multiple of the total delay time up to 1,000 microseconds, with certain additional tips up to 5,000 microseconds. Manufacturer, Inc., 68 Water St., Weymouth, 88, Mass.

► **Microminiature thermistor**, Series D, available in resistance values of 50 ohms to 10 megohms, with temperature coefficients of -3.9%/deg. C. to



-6.8%/deg. C. for operation over temperature range of -50C to 150C. Thermistors are available in pellet dimensions of 0.060, 0.190, 0.260 and 0.350 in. with standard thickness of 0.021 in. Manufacturer: Galien Industries Inc., 282 Danbury Ave., Danbury, N. J.

► **Lightweight tracking wave tube**, Type RW-101, permanent magnet focused, has noise figure less than 6.9 db, provides more than 27 db gain with collector voltage of 300 v and helix voltage of 250 v over frequency range of 2 to 3.4 gc. Tube weighs 14.5 lb. with magnet, can be operated in any position, is priced at approximately \$2,000. Manufacturer: Wintec Electronics Tubes, Inc., 175 West Collins St., Des Plaines, Ill.

► **Transistorized noise spectrum**, is regulated in noise to prevent leakage,



is interchangeable with MEL Types CM65 and CM70, but can be operated at temperatures up to 125C at full output ratings. Application data is available in Bulletin No. 1234. Synspec Electronics, 327 Marshall St., North Adams, Mass.

WHY BLACK?

New Cessna Models Have Styling Changes

Large interior and slight increase in useful load make the 1967 Cessna 1100L, with improvements in the new Models 182/Skylark and 210 being presently confined to styling and additional equipment.

Public revealing of these three airplanes in December made out Cessna Aircraft's new 1967 model line at 39 airplanes. One plane, however, seems to be displaced in the public eye April—the new tandem-engine two-boom 40-place Silverstar, on which details have been reported earlier (AVW Oct. 22, p. 103).

Cabin Enlarged

Cabin interior of the new light twin 1100L is 22 in. longer, providing additional baggage area behind the two-seat version, with reduction of this area depending on port and optional equipment. Gross weight of the airplane has been increased 100 lb. over the earlier Model 1100L, giving the new airplane a gross of 5,100 lb. Useful load is increased about 90 lb.

Increase in gross weight has been accompanied by redesign of the main landing gear and nose gear shock strut to permit full gross weight landings. The new gear accommodates air columns absorbing 50% greater landing and provides even better landings at the higher gross weight than the 1100L's gear. New gear box is of four-piece construction to take extra loads.

Engine controls also are modified to comply flexible engine stand and control assemblies, characterizing about 30 parts over the previous version.

Other Improvements

Additional 1100L improvements include new wing spar with modified venting, glide slope antenna added into the glass fiber fuselage nose ray and an accelerometer for propeller angle sensing system as optional equipment.

Optional gear includes the Navy-G Model 500 three-way autopilot.

Price of the base 1100L airplane is \$62,910. However, Wichita, working on increase over last year's model, which listed at \$59,790 on the basis of a \$2,550 price cut from the 1965 1100L.

Cessna's latest offer last year the new 1967 Model 182/Skylark, is basically a similar airplane with updated styling. It has additional equipment available, such as the Cessna Sky-Cover 90-chained transceiver and 180 channel receiver-as standard equipment in the de luxe Skylark version and coating



1967 MODEL 210 has new interior with all-aluminum frame seats.



IMPROVED STYLING, new controls give mark the 1967 Skylark and Model 182.



CESNA 310R has larger cabin, increased useful load and redesigned landing gear.

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\$1,225 plus installation on the low expense Model 182. Also available is the New O-Matic 308 landing hold device including one station coupler, selling for \$1,985 plus installation, or the single-out New O-Matic wingtip selling for \$1,125 installed. A lightweight Cessna automatic direction finder is available for \$1,137 plus installation, or is an aircraft-type directional gyro having a face with perspective scales, blue and blue horizon, which will cost \$575 plus vacuum system and installation.

Model 182 Price

Price of the base Model 182 for 1965 is \$36,498, compared with last year's model price of \$15,990, the base Six line will sell for \$18,990 compared with \$18,490 last year.

The 1965 version of the Model 210 retractable landing gear airplane also features a new interior with all aluminum frame seats and has available as optional equipment the New O-Matic 308, the New O-Matic 300, the lightweight ATF and directional gyro. The new Model 210 will sell for \$24,625 in its basic equipment configuration, an increase over last year's \$23,975 price.

Noise Reduction Work Planned for Potez 840

Addition of a larger air-conditioning ventral duct and a deaerifier are among steps being taken to lower cabin noise levels on the Potez 840 now being flown to prospective customers in North America.

Addition of four-bladed propellers to the turboprop's four Turbomeca Astazou 2 engines also is expected to lower cabin noise by as much as 2 db.

At present, a single air intake is used to feed air to the SAF's pressurization system. Dual air-intake ducts could lower the present single duct air expected to lower noise generated by the system.

Addition of a propeller tip to the engine, which is to be done for production models of the 840, will increase engine power to a maximum of 400 hp, according to Don Potez, president of Turbo-Tight, Inc. of Chicago, North American distributor for the airplane.

Other changes to be made on the production aircraft, according to Potez, include modification of two-blade power controls with power ratings of 100% for takeoff and 50% for cruise, and a retractable air duct to replace the present engine inlet.

Second Potez 840 prototype, being used as a demonstrator in North America, will continue as a solo test of the quarter (AW Oct 15 p. 121). Potez flight now has 75 production planes scheduled, according to Potez.

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Routine aerodynamic and structural tests by the US Air Force on reinforced fiber glass blades mark another first by Curtiss-Wright—first to have a fiber glass bladed propeller successfully complete the Military Qualification Test.

Designed and built by the Curtiss Division for the T-38C X-19 VTOL aircraft, this new lightweight propeller system is no longer a concept, but a proved reality. The inherent advantages are many:

Fiber glass blades are 40% lighter than conventional blades, less costly to manufacture, and far easier to repair in the field.

The successful military testing of these Curtiss-Wright fiber glass blades—a major milestone in VTOL development—may suggest further evaluation for your program. Write for our literature which fully describes the advantages these blades offer to VTOL aircraft.

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Helicopter Cargo Hook

Automatic helicopter cargo hook weighs 27 lb. and has 10,000 lb. working capacity, and 30,000 lb. ultimate strength.



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Aerospac Corp., Jackson, Mich.

Plastic Module Caps

Line of molded plastic caps for operating electronic components or modules is resistant to acids, alkalis and fungus and shows excellent features of an environment, dielectric strength, dissipation factor, and surface resistance, the manufacturer says.



Caps are available in round or rectangular configuration in a wide variety

of sizes. Caps are made of glass filled diallyl phthalate and are easily machined or engraved.

U. S. Engineering Co., 19196 Sennett St., Van Nuys, Calif.

Oxygen Pressure Potentiometer

Scale of oxygen pressure potentiometer has temperature sensitivity of less than 0.005%. Fastest through



their operating range of -200° to $+500^{\circ}$ F. A time constant of 1 millisecond and ability to withstand 50 to 2,000 cps vibration makes units suitable for aerospace engine applications.

Tetra-Sensor, Inc., Burlington, Mass.

Low-Flow Transducer

Transducer measures fluid flows down to 0.005 gpm under a wide range of temperatures and pressures, the manufacturer says.



Called "ELF" Transducer, device uses a multi-bladed, hydrodynamically balanced turbine which rotates in precise proportion to the viscosity of the fluid flowing through the meter. An electrical pick-off and amplifier to the meter generates sine wave pulses corresponding to the flow rate. Pulses are fed into digital indicators and readouts or through frequency-to-d.c. converters for use with indicating, recording and controlling instruments.

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CINCINNATI

Moss Attacks Government News Control

(Continued from page 10) The Congress of the Colon was an act of the first major public debate on subcommunist activity in the Kennedy Administration's office. It has become one of the most heated debates on this subject since World War 2 when the security for military security first began to make statements of subcommunist public good. Because of the importance of this subject to the American military, American World & Space Technology is presenting a speech made recently by Rep. John E. Chafee (R-Calif.) chairman of the House Government Information Subcommittee, to the California Post Atomic Law Conference in San Francisco. (Ed.)

Neurosurgeons across the nation have been in a state of ethical shock as recent events because of attempts by federal officials to tamper with skull-shaped government airplanes, particularly activities surrounding the Chilean case. There have been ethical dilemmas at the heart of neurosurgery. In Washington, a group of neurosurgeons who regularly cover government agencies decided they had better form a Freedom of Information Commission earlier than that of Congress. In Tulsa, members of the neurosurgical community have been in a constant state of vigilance. In the past, the committee revealed, said Dr. Robert G. Berman, a neurosurgeon, that the federal government to regulate attempts to tamper with government, and they agreed passage of a national Freedom of Information Act.

In addition, a set, new of the main branding category within the federal bureaucracy has to create a favorable effect by managing the rest of a generation. In fact, the advertising development is that Washington cartoon have wanted so long to sit up their own community, to look into the state too. For nearly eight years the Special Secretariat on Government Information of the House of Representatives has been adopting all aspects of the government's most management operations. During that period and for a number of years before that, the federal government, through its thoughtful scholars and reporters warned of the dangers of manipulation of government information.

Let me read you a pertinent comment on the subject:

It has become apparent that tighter controls are being used for greater manipulation of information for management of the news—on the Department of Defense level. Under the President's new order he will further centralize and control, a system that information officers of the armed services may be adapted to the status of a subordinate's duty on the basis of the Defense Department's policies war. The new orders establishment, then, would speak with one voice—and that the voice of a politically appointed propaganda agent.

This is not a comment on the government information controls imposed in the Cuba case although it could well apply. It is a warning in an official report of the House Government Operations Committee.

Met with the House of Representatives on June 1916.

The point is that management of government information is not a new technique. It has been going on for a long time, and a lot of us here have complained about the practice for a long time. But if government news management is an old practice that has not yet become obsolete, there have been some new and most disturbing developments in the business of government news management during the past few months.

In 1940, when the complaint against news management which I quoted was filed in an official House of Representatives report, it claimed that the publicity men in every federal department and bureau were managing the news for the greatest possible publicity effect. The problem was most apparent in the Army Defense Dept. where an "integrated news staff" of information specialists worked on the views of military units and took orders for policy, as well as economic, political, police and some other international policy.

That is so long, the case. We will have the public information reports in the next one or two weeks. Before he starts with his 10 years of newspaper background in the House, Rep. Robert Manning will be foreign and domestic news correspondent at the Staff Dept., Pierre Salinger in the White House and public information man with broad news background in top jobs in nearly every department. That publicity show will be producing and press releases, and they will select release dates that will get their stories the best possible place.

[illegible][illegible]

At the time, I pointed out that having that Order in 1951, which caused military information to be given for speech against unpopularity, restrictions on information. The speech procedure also could be used as the best common system for providing information to the citizens. The President called for, for two months ago, the House Government Operations Committee, a report that with the House of Representatives again called for single sentences of the speech system which is provided in the Executive Order. But the American action has been taken to set up a suitable, better common system.

Now, though, on occasion another



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you provided for the success of government by the press, there were no other opponents by the press but by the government, itself. Some of the correct attack was laid here in the West. In the 1960s the underground leader left and in Nevada which previously had been open to reporters and photographers, was tightly closed. Leaders of the hard-core Communists should bring attention, for press put head with I am not referring to advertisement of a member name which was explained for reasons of military security. This sort of advertisement is prohibited by law and by Executive Order, the advertisement has not been approved for publication. Leaders of the hard-core Communists should bring attention, for press put head with I am not referring to advertisement of a member name which was explained for reasons of military security. This sort of advertisement is prohibited by law and by Executive Order, the advertisement has not been approved for publication.

National Policy

You may wonder why I emphasize the problem of secrecy about military space activities. There are two major reasons. The first is that the administration has no objection to military space activities that protect their military security information. But the second is that the administration has no objection to military space activities that protect their military security information. But the second is that the administration has no objection to military space activities that protect their military security information.

Growth of Secrecy

Over the last few years the tide has run in the growth of secrecy about the growth of activity in other important areas. There was a new secret story last spring reporting that a new Defense Dept. order required secrecy about all military space activities. This was a law following news when the Special Subcommittee on Government Information argued that disclosure of the reported secrecy order is that there could be public discussion and misunderstanding of the necessity for limited secrecy about military space activities. I can say with some confidence that this is a new secret story. Just this week, Assistant Secretary Arthur Schlesinger issued a memorandum to the public in Washington that in the military space activities, there have been no such as handling of information of military space topics. The last disclosure relating to secrecy policy for military space programs has not been disclosed, but the system for managing the information about military space activities is not in the open.

Assistant Secretary Schlesinger's new memorandum makes the Defense Dept. order to prevent "all military space activities" about military space programs consistent with the policies of military security. The memorandum encourages military space programs to limit disclosure about their activities in Assistant Secretary Schlesinger's Office for consideration of whether the information can be made public. No one should make efforts to tell the public about military space activities while protecting that information necessary to the nation's defense. But an important aspect of the new memorandum is that all questions provided for the success of government by the press, there were no other opponents by the press but by the government, itself.

leaders by military agencies, whether they be for a military program or to prevent information of a military nature, are covered by the market of secrecy. All information about military space activities is covered by the market of secrecy. All information about military space activities is covered by the market of secrecy. All information about military space activities is covered by the market of secrecy.

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Following the September report of Russian satellites, there has been a complete blackout on information about Russian satellite activities. No longer does the Russian satellite report its own Russian satellite activities in other—old news items are removed with a blacked-out policy by the Russian. For example, the Soviet press is no longer allowed to report that the Russian satellite has been launched. I and a small group reported that it had traveled more than 400 miles into the air. Our official history of Soviet activities is almost closed. The same issue covers the Soviet frontiers of Canada. On Sept. 17, October 19 and 20, and October 19 and 20, I am not avoiding secrecy by telling you their facts, even if they are not in the open. Our official history of Soviet activities is almost closed. The same issue covers the Soviet frontiers of Canada. On Sept. 17, October 19 and 20, and October 19 and 20, I am not avoiding secrecy by telling you their facts, even if they are not in the open.

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Crusader Air Duct

Engine air duct of Chance Vought F-4C (previously F-4U) Crusader Navy fighter is shown after being stretched into the air bottom of photo. Skin is 500 semi finished aluminum. Concrete block was mounted on half-inch firm rubber pad to simulate pressure on the block during the forming process.

stopped in the quarantine, and he decided when the current government returns would be announced in the public. "It is better to withhold such information openly to be clear, the individual factor is the indicators that the individual responsibilities are based on the military intelligence can be understood at the expense of the diplomatic need to keep the American people informed about what is happening. It is still not good to insert that the government will not get and speak to the American with us, and only at the proper time. But it is really important that the American people also be told our facts so that the government does not feel itself in a deep crisis with an unbalanced public incapable of affording the necessary support and understanding."

There are the bones of the dilemma on which we find ourselves. We have in the past few weeks experienced a degree of governmental news management which is unique in peacetime. News generated by government actions absolutely must be part of the cold war strategy. And this system works. Solon has our news network scheduled a victory in international cooperation to the victory in the Cuban crisis. Speaking and acting in the manner we must President Kennedy gives us the cold war line from becoming a media instrument. As a news instrument, it is a cold war line that the cold war communications will be brought closer to a solution of the dilemma.

The President has the Constitutional duty to inform the Congress and the public. If it is necessary for the President to divert his public relations support to assist the news generated by government actions it appears that he has the power to do so. But the Cold War, the press and the American public has the responsibility to examine, and tell the extent of that power. Some of our past steps were certainly not taken to permit equitable management of the

news about day today government operations and to prepare for the information problems which will arise as they develop. The first step is a broad public disclosure of the situation and the past must be first discussed. A number of news organizations already have made plans to meet with government officials and receive the discussion which was generated by day administration controls against during the Cuban crisis.

These discussions must include careful consideration of the news management that might develop prior to the Cuban crisis, the selective manner which is today making open access, the news management required in the modern tests in Korea and the Pacific and all of the other developments which have received too little public consideration.

The discussion also must look to the future, to the question of what sort of news management is planned in the event of an actual crisis, short of war and the question of what information materials are planned should there be no actual conflict. I hope much consideration of the problem will result in a resolution of the shared State and Defense Dept. discussion regarding the players to travel every conflict by a reporter. President Kennedy has directed a change in the State Dept. directive and he has promised to withhold the Defense Dept. directive if it indicates the flow of essential news from the Pentagon. I believe it does restrict the flow of news for a directive to report all press contacts as nothing was then so through to channel all information through the Pentagon policy office.

We also must work out a system to replace the open of the current guidelines on sensitive news such as the 13-point memorandum which a group of news officials have accepted. We must not wait until another crisis forces the government to set up a temporary system, such as the one set up in the Cuban crisis, and then to adduce its knowledge. We have just gone through a disturbing period of exploration and an unbalanced government news management. If, or when we become more that some action will be taken the next time the cold war situation is lost. As we had better get busy right now to make sure the people's need to know the facts of government is fulfilled. We must create the system of government information necessary to a democratic society or we will be in our system of government dangerously weakened.

Aeronastronic Builds Future Command Post

Fast Mater Co.'s Aeronastronic Division will train Aeronautics personnel in the operations and maintenance of "Operations Control" the battlefield command post of the future—where Aeronastronic is developing at its Newport Beach, Calif., Engineering and Research Center.

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BUT WHAT ABOUT TOMORROW?



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IBM asks basic questions in machine organization

How efficiently can we use computers?



This type of machine input-output program is relatively time-consuming and costly to prepare, particularly when input-output routines are used repeatedly.

In an effort to increase efficiency, more and more innovations have been built into computers in the form of control. This means fewer written programs are necessary. However, built-in computer instructions that facilitate the solution of a particular type of problem also limit the computer's capacity to handle a variety of problems. Because of this, too in studying new ways of organizing data processing systems. The goal is to improve the speed and productivity of specialized problem solving without sacrificing the flexibility of general-purpose machines.

Computer architects are now attempting to achieve the most efficient relationship of both instructions and programming systems to the range of problems to be solved. They are transferring many input-output and programming operations to built-in circuitry. One example is the use of 7090 data channel shown above. In addition, they are developing common languages which make it possible to use the same program on different machines. At the same time, they are working to increase over-all speed by



input of machine data with a unit such as the IBM 7090 also channel reduces program a rising, speeds up processing, and cuts the cost per answer.

developing time-sharing and communication techniques that make greater use of the entire system. For example, new programmers have developed a method by which a large computer can handle a number of problems at once, thus reducing the cost per answer. This involves a supervisory program that manages the execution of the multiple tasks assigned to the central processor. In addition to these multiple problem-solving techniques, an experimental system permits the computer to handle several different programs simultaneously. From developments such as these will come the advanced architectural techniques necessary for a new generation of computers.

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3 The NASA satellite mission is part of Oct. 18 Vol. 2, No. 16 delinquent against the Soviet Sept. 4 Venus probe launch (the Aug. 25 launching is later). Thus there is no losing

Yang Nien, 12 editions of *Women Work*, has an excellent general coverage of Vietnamese training for anti-gerrilla warfare, however, our response is a little mixed up. For example, the T15 on p. 92 do not have USM markings. They are in fact, marked with Vietnamese insignia. The markings are quite similar to evidenced in the enclosed page; a black and white photo graph makes it even more difficult to de-

The AD6 also has *Virtuosus* seating: 18, built-in seating on the engine room underside lighter. Both the C125 and the AD6 also have the *Virtuosus* for both which is shrouding, cabin, and seat stages the outside cabin steps, being twice the width of the mounting stages.

The C125 aircraft appears to have the standard USAC systems.

Another interesting point concerning the T-25s is that they are ex U.S. Navy T-28C wrecks. This is indicated in the Navy brown numbers on the tail and the all-ways landing configuration. The T-28C was a carrier-on-deck carrier and so each had a cutout for the bulkhead and tail bumper.

I hope that you did not consider me comments in the "astippling" area for they are offered solely as constructive comments.

Harry Gray



Any rational, careful First Class Fella (WW Oct 19, p. 21) has excellent and deserves a medal, believe though he, is not enjoying it! Obviously, the great majority of airline passengers feel that "first class" flights are not worth the extra ex-

A second personal experience, shows that there is a strong possibility that passengers are during a gradual declining class, as there are simply become more and more they are being replaced by first class and elites.

Mr. Patterson of United Air Lines was quoted extensively in some editorial. Perhaps the gentleman can offer some good reasons for the cancellation of the United 4:10 p.m., "smoke-free" DC-6 flight from Cleveland to Hartford, because the other

Station Floek welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, *Station Floek*, 330 W. 32nd St., New York 26, N. Y. Try to keep letters under 300 words and give a proper identification. We will not post anonymous letters and names of writers will be withheld on request.

more powerful to be on either of our "best
river, sub." (K-4)

On this issue, a limited choice still is not worse a limited pay freeze. Cleveland is 10 on the morning. So it is not the fact that is disturbing but rather the broad Union, strong and effective, opposition is brought up the time will come when pay raises are forced to pay the consistent fact quoted in two editorial worth because to choose what than "first class" crew.

Barry G. Williams
Member, Co.

The policy of withholding information is viewed negatively by our government partners. A teleconference conference and posters of conferences that bespeak a bad reaction on our time. In particular, I would like to point out a strong reaction concerning the abuse of information on the space activities of both the USA and the USSR. The following facts speak for themselves.

I believe that on the landing of airlines from Vandenberg Air Force Base in California it should be has been clearly indicated in newspapers the trade customers.

TV
2) During the week of Oct. 8 the Western Edition of the N.Y. Times included an article discussing the procedure of "registering" with the United Nations Committee on Disarmament 66 U.S. hearings including most 30 of the "secret" satellite broadcasts from VAFB. In this register were given name, age, gender, social, postal and other information of all the thousands of satellites in contact with the names 71 of all the satellites. Nothing in the register is noted as being classified.

¹ Mr. James Walsh, Director of NASA, recently revealed to the public the fact that the U. S. has detected since December of 1965 five failures and one "partial success" in Soviet attempts to reach Mars and Venus with interplanetary spacecraft. Among these were two attempts to place spacecraft on its journey to Venus on Aug. 25 and on Sept. 1 of the same year.

⁴ Following the procedures established during the HCV of the spacecraft of Aug. 25, having attached earth orbit was called 1962 alpha p. The Sept 1 launch is then 1962 alpha q and other launches in the series between Aug. 25 and Sept. 1 being then accounted for by 1962 alpha r and 1962 alpha s (q, r, s, etc. were not introduced since it is a common article like alpha the word).

at the Sept. 7 launch, when as first Minister 2 is alpha (rho) Alphaagru was a letter from USSR.

5 The NADA utility situation is part of Oct. 10 Vol. 2, No. 16 debate against the Sever Sept. 5 Voters' probe against (the Aug. 25) launching a letter). Thus there is no taking in either the object is not assessing or as the discussed object (i.e. combined) left.

The fact, listed above, demands, you can guess, to be written down. Items 1 and 2 above are closely connected. Items 3, 4, and 5 are also at variance with each other.

The act of censorship and contradiction, item 6, is keeping into the line of that Cuban shortness. Cuba has a sense of suffocating in the United States of America. The act of strategy, item 7, is the Soviet Sept 1 launching order, on the grounds of the attempt to reach Yaguajay.

Continued cooperation by Letter Box users for providing a variety of detailed rail address problems.

The protein presented in this issue, at pp. 20 (p. 81) *Environm. Microbiol.* 140, covered some doubts of local breeding and about it impossible but it is not involved in a scheme which is simpler than the one given in your issue of Nov. 3 (p. 31). This means a gain before the acquisition of those who could like to perform a third, without accomplishing the similar sense task of finding the product of 1081 consecutive numbers.

$$\gamma_{\text{eff}} = \left[\frac{1000}{V} n^2 \right] + 2$$

The final variable is equal to the product of all pairwise variables from 0 to 1000 plus 1.

Then the last number is obtained by finding the product of only 10% numbers. The number 5 can also be omitted by a still shorter solution.

The point of the merge sort, evaluation any number up to 1,000 which is added to the first number is a multiple of one of the factors of the first number.

Dr. W. C. Cramer
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Abstracts: *Psychiatry* 1991; 24: 101-102. **Free.**

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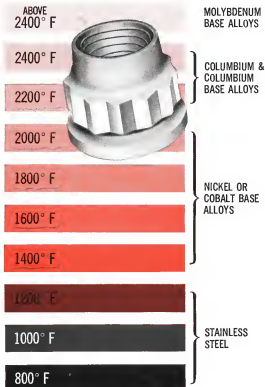
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Reduced hex, lightweight nuts to develop full tensile strength of bolts of 140 KSI at temperatures -300°F to 900°F. A286 stainless steel, silver plated. Sizes 2-56 through 3/8"-24.



LH3610

Special close-clearance nuts to develop tensile strength of 160 KSI at temperatures to 900°F when used on bolts of same material. AMS-6304 chrome moly vanadium steel, silver plated. Sizes 10-32 through 3/8"-24.



LH4167

High performance nuts to develop full strength (160 KSI) of bolts of same material at temperatures -300°F to 1400°F. Used for reduced times and loads up to 1800°F. Rene 41, silver plated. Sizes 10-32 through 3/8"-24.



Shank type nut for turbine flange sections. Develops full tensile strength of Waspalloy bolts up to 1400°F. Waspalloy PWA686, silver plated. 1/4"-28 size, two shank lengths.



RG38-2644

Radial gang nut strip for flange assemblies, to develop full strength of bolts of 347°F or 303 stainless steel at 1200°F. Nut-AISI 347-FM, silver plated, size 5/16"-24. Channel - AISI 321 passivated.



ELASTIC STOP NUT CORPORATION OF AMERICA

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